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THE MEDICAL DEPARTMENT, UNITED STATES ARMY
PREVENTIVE MEDICINE IN WORLD WAR II

Volume 13
SPECIAL FIELDS

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IN WORLD WAR II**

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Lieutenant General LEONARD D. HEATON

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Editor in Chief

Colonel ROBERT S. ANDERSON, MC, USA

Editor for Preventive Medicine

EBBE CURTIS HOFF, Ph. D., M.D.

Assistant Editor

PHEBE M. HOFF, M.A.

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The volume comprises the official history of the Medical Department of the United States Army in World War I, as prepared by the Historical Committee, United States Army Medical Department, and published under the direction of The Surgeon General, United States Army. These volumes will include the history of the Medical Department as organized before and after the professional organization was established, and the history of the Medical Department as organized in the United States.

Volume IX

SPECIAL FIELDS

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Medical Service in World War I

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Medical Service in World War I

Vol. I. Organization, Medical Administration

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Vol. III. Medical Service in World War I

Medical Service in World War I

Vol. I. Medical Service

Medical Service in World War I

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Medical Service

MEDICAL DEPARTMENT, UNITED STATES ARMY

The volumes comprising the official history of the Medical Department of the United States Army in World War II are prepared by The Historical Unit, United States Army Medical Department, and published under the direction of The Surgeon General, United States Army. These volumes are divided into two series: (1) The administrative or operational series; and (2) the professional, or clinical and technical, series. This is one of the volumes published in the former series.

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Authors

GAYLORD W. ANDERSON, M.D.

Mayo Professor and Director, School of Public Health, University of Minnesota, Minneapolis, Minn. Formerly Colonel, MC, AUS. Director, Medical Intelligence Division, Preventive Medicine Service, Office of The Surgeon General, U.S. Army, 1943-45.

STANHOPE BAYNE-JONES, M.D.

Brigadier General, USAR (Ret.). Formerly, 1942-46, Deputy Chief, Preventive Medicine Service, and Administrator, Army Epidemiological Board, Office of The Surgeon General, U.S. Army; Director, United States of America Typhus Commission, War Department.

W. LEIGH COOK, JR., M.D.

Assistant Professor of Medicine, University of Pittsburgh Medical School; Consultant, Internal Medicine, Aluminum Company of America, and Westinghouse Electric Corporation; practice in Internal Medicine and Cardiology, Pittsburgh, Pa. Formerly, Colonel, MC, AUS. Director, Occupational Health Division, Preventive Medicine Service, Office of The Surgeon General, U.S. Army, 1944-45.

GUSTAVE J. DAMMIN, M.D.

Pathologist-in-Chief, Peter Bent Brigham Hospital, and Elsie T. Friedman Professor of Pathology, Harvard Medical School, Boston, Mass. President, Armed Forces Epidemiological Board. Colonel, MC, USAR. Laboratory Officer, 1941-42, and Commanding Officer, 1943-44, Puerto Rican Department Laboratory; Director, Laboratories Division, Preventive Medicine Service, Office of The Surgeon General, U.S. Army, 1944-46.

WILLIAM L. HAWLEY, M.D.

Clinical Associate Professor of Medicine, Medical College of Alabama, Birmingham, Ala. Formerly Major, MC, AUS. Assistant Epidemiologist, European Theater of Operations, U.S. Army, 1944-46.

GRANVILLE W. LARIMORE, M.D., M.P.H.

Director, Florida Regional Medical Program, Tampa, Fla. Formerly Major, MC, AUS. Chief, Health Education Unit, Preventive Medicine Service, Office of The Surgeon General, U.S. Army, 1943-46.

KARL R. LUNDEBERG, M.D.

Medical Director for Public Assistance Division, Minnesota Department of Public Welfare, Minneapolis, Minn. Formerly Colonel, MC, AUS. Chief, Preventive Medicine Section, and Surgeon, U.S. Army Forces, India-Burma Theater, 1944-46; Director, Preventive Medicine Division, Office of The Surgeon General, U.S. Army, 1946-47.

ELLIOTT S. A. ROBINSON, M.D. (Deceased)

Assistant Professor of Public Health, Harvard University Medical School, Boston, Mass., 1933-47; Director, Division of Biologic Laboratories, Massachusetts State Health Department, 1933-47; Director, Laboratories Division, Preventive Medicine Service, Office of The Surgeon General, U.S. Army, 1943-44; Assistant Chief, Preventive Medicine Service, 1944-46. Colonel, MC, AUS.

LUCILLE DEE RUBIN, B.A.

Vice President, Biomedical Communications Associates, Inc., New York, N.Y. Formerly Chief, Publications Section, New York Department of Health, Albany, N.Y.

CONSTANTIN P. YAGLOU, M.M.E. (Deceased)

Professor of Industrial Hygiene, Harvard University School of Public Health, Boston, Mass., 1947-60. Lieutenant Commander, USNR.

Foreword

As military preventive medicine is a specialty composed of specialties, the term "special fields" might well be applied to any and all of the chapters in all of the volumes in the historical series entitled "Preventive Medicine in World War II." The title of this volume was adopted for convenience to include subjects not readily classifiable in other volumes. That such a device was found to be necessary is further expression of the extraordinary enlargement of the scope and content of military preventive medicine in World War II. Traditional boundaries were transcended by activity which grew in all directions to meet the challenging situations of a global war, and the problems of preservation and maintenance of the health of troops in all parts of the world.

From the beginning of the preparatory period in 1939 and throughout the war, deficiencies in the training of medical and sanitary officers and enlisted men in preventive medicine, public health, hygiene, and tropical medicine were constantly under scrutiny. Remedial actions were taken by providing special courses of training, including seminars, professional meetings, demonstrations and practical exercises, and by the issuance of instructive material.

Toward the end of the war, the Preventive Medicine Service, Surgeon General's Office, and other organizations became acutely aware of the need for intensive education of the individual soldier in the causes and prevention of disease. A program of health education in preventive medicine was developed and implemented.

In World War II, the Army became the largest employer of civilian and military workers in factories, plants of all types, ordnance shops, and a vast variety of manufacturing enterprises. To meet the resultant problems of health hazards, the Preventive Medicine Service, in collaboration with many agencies, developed an effective program for occupational health and industrial hygiene. These activities far exceeded any previous military or civilian effort in this special field.

Disabilities due to environmental and climatic factors assumed a new and unprecedented importance in World War II. Cold injuries were almost totally confined to frontline soldiers fighting on the cold and wet battlefields of Europe, while injuries for effects of heat (excluding sunburn and burns) were three times greater in the continental United States than in the theaters of operations. New investigative methods were developed in an attempt to provide adequate indoctrination of officers and men in the principles of prevention of heat trauma and cold injuries.

The collection of medical intelligence was an entirely new undertaking in the Preventive Medicine Service during World War II, although this

was not the first war in which medical problems had played an important and decisive role in determining the course of military operations. For centuries, pestilence and disease have bedeviled and even overthrown the best of military plans. Although medical intelligence was still a developing field at the end of World War II, the information that was collected, analyzed, and disseminated proved to be valuable for both medical planning and strategic military operations.

Since the Civil War, little has been written about preventive medicine for enemy prisoners of war. In this volume, the unprecedented World War II experiences with the handling and care of multitudes of enemy personnel captured in Europe, Africa, and in the Pacific areas are distilled, and the events are documented from written records and photographs. The chapter is regarded as a new and valuable addition to the history of military preventive medicine.

Medical laboratories of all types were developed and deployed globally in World War II. In no other military publication have the medical laboratories of the Army been so fully described and evaluated. This chapter is a notable and original contribution to the history.

Readers and students of military history will find this volume to be a compendium of unusually interesting and valuable information. I commend it heartily and believe it will occupy a deserved position of excellence in the series of volumes on the history of Preventive Medicine in the U.S. Army in World War II.

LEONARD D. HEATON,
Lieutenant General,
The Surgeon General.

Preface

In developing the overall plan of contents and organization for this volume of the history of preventive medicine in the U.S. Army in World War II, the editors, in consultation with the Advisory Editorial Board, have given emphasis to a number of special subjects that deserve particular attention, and which do not fit appropriately into the other volumes. These special subjects are presented here. Several of the chapters have been in preparation for many years, and all of them represent the results of painstaking efforts to insure accuracy of content, appropriate emphasis, and expert evaluation.

Grateful thanks are extended by the authors and editors to all who reviewed the chapters and made valuable suggestions:

The first special subject is Dr. Karl R. Lundeborg's chapter on training in preventive medicine of Medical Department officers and enlisted personnel. The reviewers for this chapter were Col. Richard P. Mason, MC, Col. Charles H. Moseley, MC, and Dr. Marcus D. Kogel, as well as Brig. Gen. John Boyd Coates, Jr., former Editor in Chief and Director of The Historical Unit, U.S. Army Medical Department.

Dr. Granville W. Larimore and Miss Lucille Dee Rubin's chapter on health education of troops was reviewed by Dr. Tom F. Whayne and Dr. Thomas B. Turner.

Dr. W. Leigh Cook, Jr., is author of the chapter on occupational health and industrial medicine. A number of the activities described presented a new concern of the Medical Department as the Army entered more deeply into industrial production. Dr. Anthony J. Lanza, Dr. Whayne, Dr. Joseph H. McNinch, Dr. Raymond G. Hussey, and Dr. Willard F. Machle reviewed this chapter. Doctors Hussey and Machle also prepared some of the sections.

Professor Constantin P. Yaglou's and Dr. William L. Hawley's respective sections of the chapter on disabilities due to environmental and climatic factors brings into focus a subject whose importance stems from the global character of military operations in World War II. Doctor Whayne reviewed this chapter as well as Dr. Gaylord W. Anderson's chapter on medical intelligence. This significant chapter draws attention to many sensitive areas and was also reviewed by Dr. Douglass W. Walker, Dr. Stanhope Bayne-Jones, Dr. Elliott S. A. Robinson, and the staffs of the Technical Liaison Office and the Medical Intelligence Office, Office of The Surgeon General.

Doctor Bayne-Jones' chapter on enemy prisoners of war is a highly original contribution drawn from a large number of varied and unusual sources. This important chapter was reviewed by members of the Advisory Editorial Board; The Provost Marshal General, Department of The Army,

1960-64; and the Chief Historian, Office of the Chief of Military History, Department of the Army.

That research and laboratory support have become essential in preventive medicine is illustrated throughout this volume and, indeed, the entire series. The chapter on medical laboratories by Dr. Gustave J. Dammin and Dr. Robinson is a colorful and expert historical account, containing, for example, a detailed picture of the setting up of laboratories in Manila after its recapture. Dr. Robinson applied his remarkable experience and knowledge to this manuscript and also served as one of the first members of the Advisory Editorial Board. Unfortunately, he died before his chapter could be finished, and Dr. Dammin brought it to completion. Assistance was also given by Dr. Francis E. Council and Dr. Audrey A. Bill. The reviewers of this chapter were Dr. John E. Gordon, Dr. A. James French, and Dr. Ralph S. Muckenfuss.

The authors and editors are also greatly indebted to Mr. E. L. Hamilton, Director, Medical Statistics Agency, Office of The Surgeon General, and Mr. L. I. Oliver, Chief, Statistical Analysis Branch, Medical Statistics Agency, who not only provided essential data but also checked and reviewed all statistical information contained herein. The maps were prepared by Miss Jean A. Saffran, Cartographic Draftsman, Special Projects Branch, The Historical Unit. Research assistance was provided by the historians of the General Reference and Research Branch, The Historical Unit.

The editors are grateful to the authors who undertook the long and exacting task of writing these chapters for they have taken their responsibilities seriously and have striven to present realistic accounts of both successes and failures as well as the difficulties that lay in the way. It is difficult to express adequately the thanks due to the reviewers. In fact, one could write a fascinating account that would indeed bring out the dedication of all those who have been associated with the preparation of these volumes.

Of especial importance has been the encouragement, direction, and deep concern of members of the Advisory Editorial Board, not only as a body, but also for their individual help and advice. Dr. Bayne-Jones, Chairman of the Board, has imprinted upon this volume, as upon the previous ones, the stamp of his wisdom, sound judgment, and meticulous scholarship. He has not only contributed a chapter to this volume, but has also reviewed the entire manuscript in detail. His contribution has been immeasurable, and the editors have pleasure in recording their appreciation to him.

The Editorial Office for the preparation of the preventive medicine historical series is located at the Medical College of Virginia, now the Medical Sciences Division of the Virginia Commonwealth University, Richmond, Va., and functions under a contract with the Office of The Surgeon General. Again, the editors wish to express their appreciation to the Provost, the Comptroller, and other officers of the Medical Sciences Division for their interest and valuable cooperation that have made completion of

this volume possible. In addition, thanks are due Col. Robert S. Anderson, MC, USA, present Editor in Chief and Director of The Historical Unit, U.S. Army Medical Department, for his support in the preparation of the history of the Medical Department, U.S. Army, in World War II, of which this series is a part.

Finally, grateful acknowledgment is made to the editors, Editorial Branch, The Historical Unit, who performed the final publications editing, and to Mrs. Cyrilla E. Hickey, Editor, who prepared the index for this volume.

EBBE CURTIS HOFF, Ph. D., M.D.

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CHAPTER I

Training

Karl R. Lundeberg, M.D.

HISTORICAL NOTE

It is appropriate to begin this chapter on training¹ with a brief reminder of some of the salient features which form a background to the subject. The years following the Civil War were inactive from the military point of view, but they covered a number of developments which were of supreme importance in medicomilitary history.

Scientific knowledge, as exemplified by the work of Louis Pasteur in founding the science of microbiology, became the basis for intelligent action in the prevention of disease and began to take the place of the empirical methods which had governed medical practice in the past. These new discoveries were neither complete nor sufficiently well known to have had much effect in the Spanish-American War because of the ignorance and neglect of well-trained procedures of sanitation. The very failure to control disease in that war did much to stimulate the development of preventive medicine in the Army in the years that followed.

The Medical Department became more closely integrated into the organization of the total U.S. Army. Both the Medical Corps and the Hospital Corps of enlisted men were given instruction in military procedure in addition to their professional and technical training. The importance of field sanitation was realized and such matters as water purification, waste purification, waste disposal, and insect control became of great concern to both medical and line officers. Instruction in these areas was given throughout the Army.

By the beginning of World War I, appreciation by the American public of the importance of proper sanitation was so general that there was no difficulty in its acceptance in the Army. "All in all then, it is very possible that no army had its sanitary conscience so well developed as our own when we entered the World War. Certainly no American Army ever before realized to nearly an equal extent that its good health was very largely in its own hands."²

¹ (1) Much of the basic material used in this chapter is taken from Goodman, Samuel M.: *A Report of the Training of Medical Department Officers, 1 July 1939-30 June 1944*. [Official record.] (2) Acknowledgment is made to Mrs. Phebe M. Hoff who made an expanded revision of the original draft prepared by the author.

² The Medical Department of the United States Army in the World War. Washington: Government Printing Office, 1923, vol. I, p. 74.

The advances in medical knowledge were being put to practical use almost as soon as they were published. Yellow fever, typhoid, and the so-called "filth" diseases were being controlled. Other diseases, especially those of respiratory nature, were still unsolved problems and the subject of continued research. Immunization with vaccines and sera were now used in conjunction with sanitary procedures.

The department of the Surgeon General's Office which was most concerned during World War I with the prevention of disease was the Division of Sanitation. Included in its sphere were both public and personal hygiene and other procedures which were beginning to be known collectively as preventive medicine. A distinguishing feature of the Division of Sanitation, and one which continued to be strongly emphasized in World War II by Lt. Col. (later Brig. Gen.) James S. Simmons, MC, Chief of the Preventive Medicine Division, was that this division was involved in the operation and administration of the U.S. Army as a whole more than any of the other divisions of the Surgeon General's Office. For the Division of Sanitation to be effective, cooperation was necessary between its officers and those in the general chain of command. Training in preventive medicine, therefore, had to be a dual procedure; that is, the medical officer needed to understand the military demands made on the line officer, and the line officer needed to know the significance and general methods of his adviser, the medical officer. Failure to maintain this two-way communication usually led to failure to prevent disease.

In the peacetime Army, the medical inspector was the individual charged with responsibility, under the surgeon, for advising and supervising all preventive, sanitary, and public health activities of the command. Formerly known as sanitary inspector, the position had been part of the Army Medical Department organization since 1818, although it had lapsed from time to time. It was firmly reestablished in 1913 and was operated so effectively throughout World War I that the position became an essential and integral part of the Medical Department. The sanitary inspector was charged with making reports and specific recommendations for correction or improvement of housing conditions, purification of food and water, methods of waste disposal, failure of sanitary discipline, and lack of equipment or supplies which might threaten the health of troops, as well as with evaluation and improvement of laboratory services. He was required to keep statistical records regarding the sanitary program.³ The title was changed from sanitary inspector to medical inspector since the former title was believed to limit the scope of the public health effort and to neglect the enormous breadth of the preventive medicine problems which faced the Army in its global conflict. While the majority of these officers were medically trained, between October 1942 and 1944, there were a few members of the Sanitary Corps who occupied the positions. Army Regulations No.

³ (1) Army Regulations No. 40-205, 15 Dec. 1924. (2) Army Regulations No. 40-270, 21 Apr. 1923.

40-200, "Medical Inspector," issued on 3 November 1944, and War Department Circular No. 327, "Conservation of Medical Corps Officers," of 8 August 1944, directed that all medical inspectors be members of the Medical Corps and be defined as the preventive medicine officers.

A Training Division was set up in the Surgeon General's Office in 1921. Professional and technical training centers such as the Army Medical School, Washington, D.C., and the Medical Field Service School, Carlisle Barracks, Pa., were established. The essential features of public health were implicit in their curricula. By World War II, therefore, practically all Regular Army medical officers on duty, and they numbered about 1,300, were well grounded in the basic principles of etiology and control of such diseases as were known at the time.

Fortunately, the impetus given to tropical disease investigation by the distinguished achievements of Maj. Gen. George C. Sternberg, Maj. Walter Reed, MC, Maj. Gen. William C. Gorgas, and other pioneers in environmental control was maintained, and the Army had a small but devoted band of enthusiasts who continued to study the control of malaria, amebic dysentery, and the tropical deficiency diseases. An Army Medical Research Board was established in the Philippine Islands in 1900. It was reconstituted in 1906 and remained active until 1914. A successor board, established in 1922, functioned until 1934 when it was transferred to the Panama Canal Department and remained in operation until October 1939. For many years, the Army Medical School was one of the few teaching institutions in the United States where systematic instruction in tropical medicine and hygiene on the graduate level was carried out. This effort was rewarded in 1940 by the availability of 12 or more Regular Army medical officers who were sufficiently indoctrinated in the potential military significance of the tropical insect- and food-borne diseases to sound an alarm concerning the military danger and to lay plans for meeting their threat if large bodies of troops should be called upon to fight in tropical areas.

TRAINING BETWEEN WORLD WAR I AND WORLD WAR II

The subject of training for military preventive medicine in the years between the two World Wars received considerable attention in the Army medical service schools. However, little attention was given to the formal education and development of public health specialists in this period. Probably no more than 12 Regular Army medical officers who had earned advanced degrees in this vital military specialty were on duty when mobilization for war commenced in 1939. Several additional officers had earned advanced degrees or diplomas in European or American schools of tropical medicine and hygiene. Among the few who had been granted the doctoral degree in public health were Col. Frank B. Wakeman, MC, and Colonel Simmons. Colonel Simmons' appointment in 1940 as chief of a newly

formed Preventive Medicine Subdivision (after 18 April 1941, Preventive Medicine Division), in the Surgeon General's Office, was most fortunate as he was already an acknowledged authority on malaria and had taught bacteriology and tropical diseases for many years at the Army Medical School. Colonel Simmons' vision, organizational ability, and understanding of the training problem made him the key person in the Army's emergency program for the training of specialists and the development of a preventive medicine program to protect the armies that were shortly to be widely dispersed over the world.

The history of training in military preventive medicine in World War II is closely associated with the peacetime Army medical training establishments—the Medical Field Service School and the Army Medical School. For more than 20 years, these schools had emphasized military sanitation and hygiene in their curricula and had given the majority of Regular Army medical officers an indoctrination in preventive medicine such as few civilian physicians in the United States had received. While most of the 1,300 medical officers on duty in 1941 were to concern themselves primarily with administrative matters during World War II, they also constituted a hard core of "prevention mindedness" in the expanded wartime services that, by and large, enabled sound training, emphasis, and doctrine to be accomplished.

The peacetime pattern for the training of Medical Department officers was designed to meet two basic needs: One, the need for training officers in the principles of military art and science and in organization and administration to enable them to discharge effectively their command and staff functions in the operation of medical units and installations; and two, the need to supplement the professional training which these officers had received in civilian life with graduate instruction in the professional specialties of medicine, surgery, preventive medicine, neuropsychiatry, dentistry, and veterinary medicine in their particular application to military practice.⁴

For each of these two aspects of officer instruction, a separate training institution was developed in the Medical Department. In 1920, the Medical Field Service School was established at Carlisle Barracks, one of the oldest Army posts in the country. Its purpose was to provide instruction in Army operation and administration; that is, to prepare civilian doctors, dentists, and veterinarians to carry out the military medical program as officers of the U.S. Army Medical Department.⁵

The Army Medical School was founded in June 1893 on the recommendation of Surgeon General Sternberg. It operated in close conjunction

⁴ (1) Medical Department, United States Army. *Training in World War II*. [In preparation.] (2) Hume, Edgar Erskine: *Victories of Army Medicine*. Philadelphia: J. B. Lippincott Co., 1943. (3) Hume, E. E.: *Training of Medical Officers for War Duty*. *War Med.* 1: 624-627, 1941.

⁵ Report of The Surgeon General, U.S. Army. Washington: Government Printing Office, 1922.

with the Army Medical Library and the Army Medical Museum—both located in Washington, D.C. The Army Medical School stressed the prevention of disease from the beginning, both in its curriculum and in its research activities, so much so that Dr. William Henry Welch once described it as “America’s oldest school of preventive medicine.” After World War I, in 1923, the Army Medical School was moved to the Army Medical Center which was being developed on the grounds of the Walter Reed General Hospital, Washington, D.C. Here postgraduate instruction continued to be given in the special medicomilitary aspects of all the medical disciplines.

There follows a description of the peacetime program both for officers in the Medical Department of the Regular Army and for officers in the National Guard of the United States and the Officers’ Reserve Corps.⁶ The history of the training of officers in the Medical Department from 1 July 1939 through World War II is a story of the revision and expansion of the peacetime program. This outline of general medical training is presented as the foundation upon which the more specific instruction in preventive medicine was built.

Officers’ Basic Training

The Medical Department basic training program for Regular Army officers was a 9-month program, conducted partly at the Army Medical Center and partly at the Medical Field Service School. The three professional service schools at the Army Medical Center conducted concurrent 4-month courses beginning in late August or early September of each year. These courses were known as basic graduate courses. They were “basic” in that they presented essential professional content prerequisite to the practice of military medicine, dentistry, and veterinary medicine, as distinguished from similar pursuits in civilian life. They were “graduate” in that the students had degrees in their respective professional fields and were presumably prepared to cope with subject matter presented in a manner characteristic of graduate schools.

When these professional courses terminated in December at the Army Medical School, the students were transferred to Carlisle Barracks for a 5-month course in military subjects at the Medical Field Service School. This course of instruction emphasized the more military aspects of the training of a Medical Department officer, and such subjects as “the school of the soldier,” military art and science, administration, logistics, field sanitation, instructional methodology, and equitation were taught. Military discipline was rigidly taught and practiced. It was entitled “Medical Department Officers’ Basic Course,” in contradistinction to the basic graduate

⁶ Report of The Surgeon General, U.S. Army, 1939–1941. Washington: U.S. Government Printing Office, 1940.

courses given at the three professional service schools at the Army Medical Center.

It was intended that the courses at the Army Medical Center and at the Medical Field Service School should supplement and balance one another, so as to provide the junior medical officer with an integrated indoctrination into the professional and military aspects of his duties.

Officers' Advanced Training

The peacetime program of instruction for Regular Army medical officers also included advanced courses for field grade officers both at the Army Medical Center and at the Medical Field Service School. There were two courses presented at the Army Medical School which were entitled "Advanced Graduate Course" and "Professional Specialist Course." The former was a 4-month course that followed formal outlines of instruction; the latter was an individualized course in medical specialties, pursued for varying lengths of time, from 2 to 4 years, depending upon the nature of the problems being studied.⁷

Advanced instruction at the Medical Field Service School was provided in a course entitled "The Advanced Course." This was of 3 months' duration and was available to field grade officers of the Medical Department of the Regular Army. Such officers were generally given the choice of taking this course either by the "correspondence school" method or by actual attendance at the school for the 3-month period.

Correspondence Courses

In addition to the basic and advanced courses in professional subjects at the Army Medical Center and the basic and advanced courses in military subjects at the Medical Field Service School, the peacetime program of instruction for officers in the Medical Department of the Regular Army included training by correspondence courses and by attending selected civilian universities and medical schools.

Correspondence courses in Medical Department subjects were available to Regular Army and Reserve Corps medical officers. They were prepared at the Medical Field Service School in its Department of Extension Courses and dealt with the military and administrative aspects of Medical Department activities at a higher level than that which was offered in the basic course.

These extension courses served a different purpose for Regular Army officers from that which they served for National Guard and Reserve Corps officers. While the former were eligible to enroll in the more elementary

⁷ Annual Report of Technical Activities of the Army Medical School, Army Medical Center, Washington, D.C., 1940.

courses which were intended primarily for National Guard and Reserve Corps officers their number was always small and totaled only 59 in the 5-year period preceding 1940.⁸

However, a correspondence course entitled "Special Extension Course for Medical Department Officers, Regular Army" was available to officers of field grade who were anticipating taking the examination for promotion to the grade of lieutenant colonel and colonel. Completion of this special extension course exempted them from the portion of the promotional examination that consisted of a medicomilitary problem. In the 5-year period preceding 1940, a total of 369 Regular Army officers completed this course.⁹

Training at Civilian Institutions

Beginning in 1920, the Medical Department made it possible for Regular Army officers to take instruction at civilian institutions in subjects not taught at service schools but essential to the development of medical specialists. The officers enrolled for such study varied from year to year, as did the subjects and the institutions involved. An allotment for the payment of the tuition was made annually under the provisions of the National Defense Act of 1920, paragraph 127a. It is interesting that of the 38 Regular Army officers who participated in the 1939-40 program of instruction in some 16 civilian institutions, none received training in public health, the majority having taken courses in clinical medicine and surgery.

Special Training at Service Schools

Special training for selected Regular Army officers was given annually at the following other service schools: The U.S. Army Infantry School, Fort Benning, Ga.; Command and General Staff School, Fort Leavenworth, Kans.; Army War College and Army Industrial College, both in Washington, D.C.; School of Aviation Medicine, Randolph Field, Tex.; and Chemical Warfare School, Edgewood Arsenal, Md. This specialized military training was given only at these schools and was normally associated with preparation for future duties with advanced rank.

In all these schools, except the School of Aviation Medicine, the annual quota of openings allotted to the Medical Department had always been small. In the 5-year period before 1940, for example, the annual quota to the Army War College had been two and that to the Infantry School had been one. The quota to the Chemical Warfare School had never exceeded three, and that to the Command and General Staff School had never exceeded four. However, the number in attendance at the School of Aviation Medicine averaged 12 for the 5-year period preceding 1940. In 1940, 17

⁸ Annual Reports of The Surgeons General of the Army, for each fiscal year from 1935 to 1939.

⁹ See footnote 8, above.

Medical Department officers of the Regular Army successfully completed the flight surgeons' assistant course at the school.¹⁰

Training in Preventive Medicine

In considering these resident and correspondence courses in basic subjects, it should be realized that, among the several disciplines, preventive medicine played an important part. The authoritative military milieu presents favorable opportunity for the practice of good public health, and it is indeed an essential feature of Army medical practice. Instruction in preventive medicine subjects included in these general courses was provided by distinguished leaders in the field such as Col. Joseph F. Siler, MC; Maj. Gen. George C. Dunham; Maj. Gen. George F. Lull; Lt. Col. Arthur P. Hitchens, MC; Lt. Col. (later Col.) Rufus L. Holt, MC; Col. Edward B. Vedder, MC; Brig. Gen. Raymond A. Kelser; and others.

ROLE OF THE SURGEON GENERAL'S OFFICE IN WORLD WAR II

Before and throughout World War II, The Surgeon General of the Army was responsible for the technical doctrine used in training medical troops, and the War Department charged him with responsibility for developing programs for the individual and unit training of all medical personnel and for preparing training publications for use by the Medical Department.

The War Department reorganization of March 1942, which reduced the staff level of the chiefs of technical services and placed them under the commanding general of the Services of Supply, or the Army Service Forces as the command was later called, modified only administratively The Surgeon General's responsibility for the promulgation of Medical Department training doctrine, program guides, and instructional materials for use with all troops under War Department control. Before the reorganization, The Surgeon General discharged this responsibility as a member of the War Department Special Staff; after the reorganization, he discharged it as a staff officer of the commanding general of the Army Service Forces. The Medical Department was one of several technical services of the Army. As chief of a technical service, therefore, The Surgeon General was considered to be the final authority on the technical content of the instructional program for all Medical Department personnel. His command relationships to the staffs of installations training such personnel however were modified on frequent occasions.

Before the reorganization of the War Department in March 1942, The Surgeon General was responsible for the supervision of all Medical De-

¹⁰ Annual Report of The Surgeon General, U.S. Army. Washington: U.S. Government Printing Office, 1940.

partment training activities not under the commander of a corps area. Until late 1940, certain corps area commanders and surgeons acted also as commanders and surgeons of the four field armies in the United States. The corps area surgeons therefore were responsible, under the commanders and The Surgeon General, for supervising the training of field medical units. In October 1940, the command of field armies was taken away from the corps area commanders and placed in the hands of the separate Army commands which were responsible to General Headquarters in Washington, D.C.

By the reorganization of the War Department in March 1942, General Headquarters of the War Department was abolished and three major commands were established which included the Army Ground Forces, the Army Air Forces, and the Services of Supply. Many General Headquarters personnel were transferred to the Army Ground Forces headquarters at the Army War College, Fort Lesley J. McNair, Washington, D.C. To the Army Service Forces (as the Services of Supply was rechristened in March 1943) was assigned the corps areas and the technical and supply services such as the Medical Department with The Surgeon General as the adviser to the Commanding General, Services of Supply, who, in turn, reported to the Army Chief of Staff. The Army Air Forces which had been for all intents and purposes practically autonomous since June 1941 had its own Air Surgeon.

The Army Ground Forces surgeon with his Ground Medical Section was responsible for the selection and training of all Medical Department personnel assigned to the class II installations where Army Ground Forces troops, including medical units, were being trained. The Ground Medical Section was also responsible for the distribution of medical supplies and equipment, the operation of dispensaries, and the maintenance of preventive medicine programs at these installations where Army Ground Forces troops were in training.

The Air Surgeon of the Army Air Forces under the reorganization was responsible for determining requirements for medical personnel, developing policies for recruitment and training of Medical Corps officers, preparing medical training courses peculiar to this corps, and lastly, determining the number of medical specialties needed for the designated types of medical training. Medical unit training in the Army Air Forces prepared air force personnel for duties with dispensary detachments (aviation), air evacuation transport squadrons, and medical supply platoons (aviation).

The reorganization found The Surgeon General continuing his responsibility for developing training doctrine for all Medical Department units which were trained by the Army Service Forces. This included the preparation of mobilization training programs; tables of organization; field, medical, and technical manuals; and all visual and other training

aids. He retained control over the selection and assignment of all Medical Department personnel to the Army Service Forces-type units. The command responsibility for the training of these medical units was given to the commanding generals of the several service commands, who actually were responsible for the training of these Army Service Forces medical units in accordance with the Commanding General, Army Service Forces. The commanding general of each service command was required to have these medical units inspected by representatives of the Surgeon General's Office for technical proficiency at least once every 6 months.

The Surgeon General's relationship to medical units assigned for activation and training to the Army Air Forces or the Army Ground Forces was, however, more remote than his relations to the Army Service Forces-type medical unit. The commanding generals of the Army Ground Forces, the Army Air Forces, and the Army Service Forces held equal status so far as their relations to the War Department was concerned. On the other hand, The Surgeon General was subordinate to the Commanding General, Army Service Forces. The Surgeon General, therefore, had to deal with the Army Ground Forces surgeon and the Army Air Forces surgeon through channels. Since The Surgeon General was so far removed by command channels for the Army Ground Forces- and the Army Air Forces-type medical units, he was not able to inspect such medical units. As far as technical training doctrine was concerned, the War Department established a working relationship between the three major commands wherein The Surgeon General (Army Service Forces) was responsible for preparing technical materials for all medical troops of the Army Ground Forces and Army Air Forces.

The Armored Force with its headquarters at Fort Knox, Ky., was placed under the jurisdiction of the Army Ground Forces as a result of the Army reorganization. This command was allowed to develop its own medical training program for its medical troops and generally enjoyed an autonomous position as did other similar specialized combat fighting arms of the Army Ground Forces.

The overall responsibility for the preparation and continuous training of all medical units and personnel in the various theaters of operations was vested in the theater surgeons, who provided for the formulation of courses and exercises in the major fields of preventive medicine. Medical training was carried out through the office of the theater surgeon, and surgeons of armies, corps areas, and divisions. After the reorganization in 1942, the commanding generals of the three major commands—Army Air Forces, Army Service Forces, and Army Ground Forces—were made responsible for the training of all medical units in the United States which were being organized and trained for overseas shipment to operate in installations and activities under their respective commands in the combat zone and communications zone.

Training Division

The Surgeon General's agency for discharging training functions was the Training Division, which operated in conjunction with the other interested divisions of the Surgeon General's Office. The Training Division developed all the Medical Department training programs published by the War Department; supervised the preparation of Medical Department technical manuals, training films, and other training aids; formulated the plans for Medical Department replacement training centers and schools; supervised the inauguration of such training installations; and inspected the units, schools, and training centers for which The Surgeon General had supervisory responsibilities, under Army Service Forces directives.

Preventive Medicine Division

In all matters dealing with preventive medicine doctrine and training, the Preventive Medicine Division of the Surgeon General's Office strove for recognition and for training of enlisted and commissioned personnel in preventive medicine fields. This was accomplished through the preparation of training and educational material, directories, and course outlines to be promulgated through the Training Division. To accomplish this task, the combined efforts of a greatly expanded Preventive Medicine Division and the advice and assistance of numerous governmental and private scientific groups and foundations such as the National Research Council, the U.S. Public Health Service, and the Rockefeller Foundation were required. Authorities in public health administration, tropical disease, nutrition, sanitary engineering, medical research, and communicable diseases were commissioned and placed on duty in the Preventive Medicine Division. A special board entitled "Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army" was founded. This later came to be known as the Army Epidemiological Board. Because of the exceptional qualifications of the civilian members of the board and its commissions, it eventually exerted strong influence in the development of sound medicomilitary doctrine and preventive medicine practice in World War II.

Anticipating the need for organization of a strenuous health effort in the face of global warfare, The Surgeon General (Maj. Gen. James C. Magee) and Colonel Simmons gave prompt thought to the placing of Regular Army and Reserve Corps public health specialists in strategic teaching and staff positions, as well as to the recruitment of public health specialists from civilian health departments, research institutions, and medical schools. These men were not only to assist in the training effort but also to fill staff positions in large military installations and tactical units of the Army. The objective was the development and assignment of professional preventive medicine specialists in such fields as sanitary engineering, epidemiology,

venereal disease control, nutrition, health education, laboratory science, entomology, veterinary medicine, and tropical diseases to all theaters where their services were needed. Furthermore, in emergency situations, these men could be called upon to bring their special disciplines together in combined assault upon particular problems. A typical example was the overwhelming occurrence of malaria in the early Pacific campaigns, a crisis which demanded concerted and highly technical skills in its resolution.

Development of Curricula

In the development of curricula for these specialties, it was recognized that most of the officers recruited for these duties were already basically trained either by civilian institutions or by virtue of their previous experience. They were not acquainted with Army life, environment, or administration. Few, if any, had had prior combat experience. Some knowledge of those technical and administrative matters which were inherently peculiar to the Army and to the various health situations which develop under field or cantonment conditions of war was imperative for these officers to adapt their civilian trained capabilities to the military service. For example, few civilian physicians were prepared to meet the challenge of venereal disease control in a military and wartime setting or to cope with malaria and other tropical diseases on such a scale as was anticipated when nonimmune soldiers should enter unsanitated tropical areas. Special schools and courses were established in military and civilian institutions to meet these needs. The length of time and the training program of these courses were developed by the Preventive Medicine Division and implemented by the Training Division with the concurrence and approval of the War Department Assistant Chief of Staff, G-3. The curricula, at first didactic and conventional, changed as lessons were learned from combat and from the difficulties encountered in keeping troops well in unsanitated areas. The incorporation of new ideas and doctrines into various training courses was facilitated by careful scrutiny in the Surgeon General's Office of official reports from overseas theaters; of unofficial reports from responsible officers in the field; by frequent training inspections by members of both the Training Division and the Preventive Medicine Division; and by investigative boards and commissions sent out from time to time by the War Department. The Medical Intelligence Division of the Preventive Medicine Service by mid-1942 was routinely distributing its surveys to all training installations. Later, through the medical technical bulletins, further intelligence reports were accessible for use in developing current curricula. This division also provided occasional lecturers in special fields to a number of training installations (pp. 333-334).

In overseas assignments, officers acquired invaluable practical experience. Many officers on their return were interviewed in the Surgeon Gen-

eral's Office by personnel of the various divisions and sections who sought to obtain current information on the training requirements for service in a particular area. From this source of information, ideas for changes and improvements in curricula were developed and implemented by directives to the various training schools and centers, and through Headquarters, Army Ground Forces, to the various field armies, corps areas, and divisions, as well as through Headquarters, Army Air Forces, to all echelons of that major command. Some of the ideas and impressions of returning officers were of great and immediate significance. An example of prime importance was the need for improved malaria discipline. This in turn led to pressure upon commanders to enforce simple malaria precautions on a company, squad, and individual basis and eventually resulted in the widespread acceptance of the doctrine that malaria control rested, in the final analysis, upon acceptance by the commander of his responsibility for disease control. On the other hand, the reports of some medical officers indicated that the facts had been learned too late. An outstanding example of this was the case of a senior medical officer in a responsible overseas staff position who, throughout a long peacetime career had deprecated and minimized field sanitation training as a preparation for war, now complained bitterly of The Surgeon General's failure to indoctrinate and train troops in basic sanitary precautions!

Maneuvers

Maneuvers were one of the most effective means of training and testing activities. By this means, troops were trained in field operations under closely simulated conditions of war. Here, both officers and men, as individuals, and small and large organizations, learned to carry out their functions in coordination. This was especially valid in training combat teams for united action. This type of training was also of particular importance in preventive medicine procedures, since they are closely involved with almost all areas of Army life. For example, in the Louisiana maneuvers in the spring of 1942, the corps surgeon's office listed among their purposes preventive medicine procedures, particularly venereal and communicable disease control, supervision of training of Medical Department units, water surveys, and sanitary inspection. On this occasion, the entire class, comprising 50 student officers of the Medical Field Service School, participated in the maneuvers as part of their course of instruction. This field experience was believed to have been of inestimable value and was recommended as an excellent training procedure.

On some occasions, it was possible to carry out formal training during maneuvers, although ideally the exercises were intended to give practical experience in subjects which had already been learned. Training films and other visual aids were used by many units.

Observers from both the Surgeon General's Office and the Medical Field Service School attended maneuvers, and their reports were most helpful in locating weaknesses. For instance, attention was frequently drawn to the lack of training in field sanitation and water purification methods in a number of units by the sanitary inspectors. In 1942-43, one of the difficulties which became evident during maneuvers was that medical officers had not been in the Army long enough to understand their non-professional duties.

Thus, it is clear that the maneuvers were valuable for two reasons: (1) They provided necessary field training experience in themselves, and (2) they were also a means of testing the adequacy of previous individual and unit training procedures.

ROLE OF THE NATIONAL RESEARCH COUNCIL

Due to the rapid expansion of the Army and the consequent general shortage of officer personnel, the program for meeting training needs in a number of professional specialties was not carried through in its entirety before the end of fiscal year 1942. However, certain facilities at the Mayo Foundation in Rochester, Minn., were utilized, and a special course in venereal disease control at The Johns Hopkins University in Baltimore, Md., were formally initiated. It was soon obvious that there were deficiencies in some of the highly skilled specialties, including preventive medicine. The National Research Council was made aware of anticipated shortages and its aid was enlisted. The various subcommittees of the Division of Medical Sciences conducted an exhaustive study of the overall training problem and presented to The Surgeon General specific recommendations regarding the use of civilian school and hospital facilities for the training of preventive medicine specialists. In addition, the National Research Council recommended schedules, length of courses, and qualifications required for trainees, and it outlined aims and objectives to obtain a balanced program of training. These suggestions were accepted, and an estimate was incorporated in the budget and approved (fig. 1). The plan for annual training in civilian institutions for these specialties is indicated in table 1.

The utilization of civilian institutions for training in military preventive medicine was only a portion of the program recommended for officer specialist training. Approximately five times as many officers were to receive training in the clinical subjects—the total for all courses was set at 3,192 per year.

This civilian training program was in addition to courses given at such military installations as the Army Medical School, where 20 to 100 medical officers received 2 months' training in tropical medicine every 2 months, and the Chicago Quartermaster Depot, Chicago, Ill., which trained



FIGURE 1.—The fall 1942 graduating class of the 8-week course in epidemiology conducted at the School of Public Health, University of North Carolina, for medical officers. Dr. Milton J. Rosenau (fifth from left) was course director.

TABLE 1.—Completed plan for professional courses in civilian institutions for medical officers, 1942

Title of course	Location	Capacity per course	Length (weeks)	Total capacity per year
Tropical medicine.....	Tulane University School of Medicine.	30-35	8	200
Epidemiology.....	University of Michigan School of Public Health.	25	8	25
	Johns Hopkins University School of Medicine.	50	8	50
	University of North Carolina School of Public Health.	25	8	25
Venereal disease control..	Johns Hopkins University School of Hygiene.	14-20	8	88
	University of Pennsylvania School of Medicine.	10	2	20
Sanitary engineering		50	12	100
Industrial hygiene.....		10-15	8	25
Total				533

Source: Annual Report, Operations Service, Training Division, Surgeon General's Office, for fiscal year 1942.

20 veterinary officers each month in the meat and dairy hygiene course, an essential part of the preventive medicine program.

TRAINING IN TROPICAL MEDICINE

Medical Department policy, supported by the Secretary of War, contemplated the assignment of medical officers trained in malaria and tropical disease control to duty with all troops dispatched to areas where such protection was needed. But, as a consequence of peacetime reduction of the forces and scanty support of medicomilitary research, there was a great dearth of Regular Army officers trained in tropical medicine. Not many physicians so qualified could be found in the Medical Corps Reserve, nor among civilians commissioned for emergency and war service. Malaria, although widely endemic at this time in Southern United States, was not considered a disease for specialization and few medical schools maintained departments of tropical medicine. By the fall of 1942, practically all the available civilian physicians who were properly trained for assignments in malaria and tropical disease control had been commissioned in the Army and ordered to active duty.¹¹

Schools of Tropical Medicine

In May 1941, backed by strong recommendation of the Subcommittee on Tropical Diseases of the National Research Council, The Surgeon General requested the War Department to grant authority to initiate a short intensive course at the Army Medical School in tropical disease control and parasitology. The director of the Training Division, Surgeon General's Office, Colonel Wakeman, in person, forcefully presented the proposition to the Deputy Chief of Staff of the War Department. Approval was received in mid-June, and funds were made available.

Assistance in organizing the course was given by Dr. Wilbur A. Sawyer, Chairman of the Tropical Disease Commission of the Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army. Recognized authorities in tropical medicine were brought in as visiting lecturers to supplement the Army Medical School faculty (fig. 2). Members of the Preventive Medicine Service also lectured from time to time. Classes planned for all medical officers assigned to duty in the Tropics and adjacent regions began in August 1941. Classes were continued until September 1945. The first three courses were of 4 weeks' duration. In December 1941, the term was increased to 2 months.

¹¹ (1) Simmons, J. S.: Preventive Medicine at the Front. *Mil. Surgeon* 94: 85-89, February 1944. (2) Committee to Study the Medical Department, 1942, Testimony, pp. 1119-1121. (3) Simmons, J. S.: The Importance of Tropical Medicine to American Business. Address to the American Foundation of Tropical Medicine. University Club, New York City, 7 Feb. 1946. [Simmons' papers.]



FIGURE 2.—A center for training, the Army Medical School was located at Walter Reed Army Hospital in Washington, D.C.

At first 20 officers, then from 30 to 40 officers, were enrolled at a time. In October 1942, facilities were enlarged to accommodate 100 officers. Then plans to double that enrollment were set in motion. By the end of 1942, approximately 500 officers had completed the training. Arrangements were made to send an additional 30 officers to the Tulane University School of Medicine, New Orleans, La., for a similar short course and for attendance at other civilian schools, but the Medical Corps of the Army was never sufficient in strength to spare from essential duties that number for specialized training which was considered optimum by the Preventive Medicine Service.

The curriculum gave paramount consideration to malaria. Next in emphasis were the dysenteries—the second major threat in the Tropics. Among infections which were rare or unknown in the United States, cholera, yaws, and various parasitic diseases were studied.

The course at the Army Medical School was unique. Enrollees were highly selected. The teachers, numbering about 30 and drawn from all

parts of the country, were the most authoritative obtainable with the assistance of the National Research Council's Subcommittee on Tropical Diseases.¹² During the first 6 or 7 months of the school's operation, The Surgeon General was in a position to propose enrollees by name, and, at the conclusion of a course, to recommend them in the same manner for suitable assignments. This situation changed radically, however, with the reorganization of the U.S. Army in March 1942. Thereafter, the Army Ground Forces, the Army Air Forces, and the service commands of the Army Service Forces sent their own candidates and received them back after training. The Surgeon General maintained a list of officers trained, checked it against the staffs of units ordered to tropical areas, and tried to obtain the necessary cooperation from theater and task force commanders and others to insure proper utilization of the specially prepared personnel. In October 1942, however, of 300 trained officers only 86 had been assigned to the Tropics and 23 had been sent to cold or temperate areas.¹³

Tropical Disease Training in Civilian Medical Schools

Efforts for education in malaria and tropical medicine for military purposes did not stop at persons already in or just entering the service. The basic need was for a pool of civilian physicians already qualified in the subject. To train them after they were commissioned was a necessary make-shift and could obviously only reach a small fraction of the nearly 40,000 physicians who were already in the Army in 1942.

With the aid of the National Research Council, therefore, urgent attempts were made to have civilian medical schools throughout the country enrich their programs by including those subjects in their curricula. Colonel Simmons proposed the immediate organization of short, intensive courses in malaria and other tropical diseases for all senior medical students and for interns in teaching hospitals. Comprehensive courses were recommended as a permanent requirement in the medical schools.

Outlines of recommended courses were prepared and made available to medical schools and teaching hospitals. Laboratory specimens and training media which had been published by the Surgeon General's Office and the War Department for use by Army doctors were also supplied. In June 1942, the John and Mary R. Markle Foundation made a grant of \$40,000 to the National Research Council to establish a number of visiting lectureships in tropical medicine. First suggested by Colonel Simmons, the purpose of the grant was to foster interest of medical students in tropical diseases, since the scope of the war had made it obvious that the study of tropical diseases must be advanced in all medical schools. Under the Markle grant, 23 authorities in tropical medicine from the United States and Latin

¹² Annual Report of The Surgeon General, U.S. Army. Washington: U.S. Government Printing Office, 1941.

¹³ Committee to Study the Medical Department, 1942, Testimony, p. 1060, *passim*.

America visited one or more of 65 participating medical schools. Prof. Harold Brown of Columbia University, New York City, N.Y., and General Magee, upon his retirement as The Surgeon General of the U.S. Army, presented most of the lectures. Continuing through the fall of 1943, the lectures were well received and resulted in a general improvement of facilities and an enlargement of courses in many medical schools.

The John and Mary R. Markle Foundation also financed transportation costs and living expenses of selected staff members of 63 of the Nation's 77 medical schools to attend the tropical medicine course at the Army Medical School, Tulane University, and other suitable institutions. In many cases, these individuals were given the added opportunity of field experience in Central America.

This Army effort toward improving civilian medical instruction for military purposes stimulated much interest, and undoubtedly enlarged the Nation's professional readiness in an important and previously neglected specialty.¹⁴

Field Training in Malaria Control

Tennessee Valley Authority.—The importance of field observation and experience, in addition to classroom training, was fully recognized. Some practice was available during maneuvers in the southern portion of the United States. For selected officers who had completed the 8-week course in tropical diseases at the Army Medical School opportunity was provided for 2 weeks on detached service to the Tennessee Valley Authority project at Wilson Dam, Ala., for participation in malaria control in the field. From August 1942 to October 1942, six such courses were given. Curtailment of the Tennessee Valley Authority malaria control staff made similar arrangements for 1943 not feasible.

Florida.—As winter conditions at Wilson Dam were not suitable for field training, arrangements were made with the U.S. Public Health Service, the Rockefeller Foundation, and the Florida State Board of Health to conduct similar field courses in that State. The length of the course was extended to 3 weeks. Between November 1942 and December 1943, 14 courses were given. During that period, 129 Medical Corps and Sanitary Corps officers attended.

Pan American Highway.—Toward the end of 1942, still another move was started to provide field experience in malaria and tropical disease control. In July 1942, the U.S. Army Corps of Engineers had taken over re-

¹⁴ (1) Simmons, J. S.: The Army's New Frontiers in Tropical Medicine. *Ann. Int. Med.* 17: 979-988, December 1942. (2) Simmons, J. S.: Tropical Medicine and the Challenge of Global War. *Am. J. Trop. Med.* 27: 1-9, January 1947. (3) Annual Report, The John and Mary R. Markle Foundation, 1942, p. 7. (4) Annual Report of Technical Activities, Medical Department Professional Service Schools, Army Medical Center, for fiscal year ending 30 June 1943. (5) Report, National Research Council, 1 July 1942-30 June 1943. [Reprinted from Annual Report, National Academy of Sciences, 1 July 1942-30 June 1943.] (6) Minutes, Annual Meeting, Division of Medical Sciences, National Research Council, 1 June 1944, pp. 23-24.

sponsibility for construction of the Mexico to Panama link on the Pan American Highway because of its possible military value. As it had done for other Corps of Engineers operations, the Medical Department had furnished officers to staff a health section. Following preliminary investigations and conferences between Colonel Simmons and Lt. Col. (later Col.) Paul F. Russell, MC, with Col. (later Brig. Gen.) Leon A. Fox, who headed the Corps of Engineers health service, authority was obtained to send picked trainees of the Medical Corps and Sanitary Corps to the project for individualized field training. Duty was from 1 to 4 months. Completion of the courses at the Army Medical School and in Florida was a prerequisite. Preparation for responsible Army assignments involving supervision was the objective of this plan.

The tours of practice duty, performed in Costa Rica and Guatemala, did not begin until March 1943. They ended in September 1943, when the Army engineers began withdrawing from the project. At that time, a plan was considered for exchanging the medical officers in training with the Corps of Engineers health service malariologists on the Pan American Highway project, thus making the more experienced personnel available for duty with troops. Relinquishment of construction responsibility by the Army in October 1943 prevented the achievement of this exchange system.

Training in the Use of DDT

Bureau of Entomology.—The development of DDT (chlorophenothane) gave rise to an entirely new and powerful technique of insect controls. All officers of the Tropical Disease Control Division of the Surgeon General's Office visited the experiment station of the U.S. Department of Agriculture's Bureau of Entomology and Plant Quarantine at Orlando. Some spent a week on temporary duty there coordinating developments at Orlando with the Army's mosquito control program.

Beginning in late 1943, groups of Medical Corps and Sanitary Corps officers who either had completed training courses in malaria and tropical disease control or were assigned to that specialty or to related work visited Orlando on temporary duty from various commands to become familiar with the latest measures against insects. Throughout 1944, demonstrations for such groups were scheduled about once a month. Enlisted personnel of malaria survey and control units were detailed to attend when circumstances permitted. Also, U.S. Navy and U.S. Public Health Service observers were accommodated.

Army commands in the Zone of Interior.—Various Army commands conducted DDT training programs of their own as the new compounds became available for use. At Fort Monmouth, N.J., in August and September 1944, a 2-day conference on the subject was held for 45 medical inspectors and another, for 44 enlisted men. In April 1945, the surgeon of

the Second Service Command reported that applicatory training had been given to representative Medical Corps officers and enlisted personnel from each post.

Army School of Malariology (Canal Zone)¹⁵

While all the opportunities previously described were utilized to excellent purpose, there was still need for (1) an Army training facility for officers and enlisted technicians and (2) advanced professional instruction for selected personnel of the Medical Corps and Sanitary Corps. Intense concern was stimulated by the malaria disasters which were occurring in the Southwest Pacific campaigns during the spring and summer of 1943. The global character of the extending military operations, regardless of the endemicity or epidemicity of tropical diseases, was further cause for anxiety. The obligation to provide more adequately trained individuals to cope with these situations was critical.

During the summer of 1943, a letter was prepared in the Surgeon General's Office and dispatched on 19 August over The Adjutant General's signature to the Commanding General, Caribbean Defense Command, requesting his concurrence in the establishment of an Army school of malariology at Fort Clayton, C.Z. It was believed that this was a most desirable location for the school, since not only theoretical, but also excellent applicatory field training could be supplied. The Canal Zone, in climate and terrain, most closely resembled the tropical areas in which fighting was taking place overseas and would provide samples of all kinds of problems in military tropical medicine. Types of permanent and semipermanent malaria control measures were already in operation and ready for demonstration. Furthermore, invaluable resources were available from the Canal Zone Health Department, the Republic of Panama Health Department, the Gorgas Hospital, the Office of the Coordinator of Inter-American Affairs (Republic of Panama malaria control), and the various U.S. Army hospitals.

As soon as favorable indorsements of the proposal were received in September, the Commanding General, Army Service Forces, was authorized to establish the school under the conditions outlined in the original proposal.

Additional personnel were to be added to the Caribbean Defense Command roster to operate and provide faculty for the school. Instructors were to include carefully selected and well-qualified sanitary engineers, entomologists, and parasitologists. The minimum personnel requirement for administrators and instructors are listed, as follows:

¹⁵ (1) McCoy, Oliver R.: War Department Provisions for Malaria Control. In Medical Department, United States Army. Preventive Medicine in World War II. Volume VI. Communicable Diseases: Malaria. Washington: U.S. Government Printing Office, 1963, pp. 23, 24. (2) Hardenbergh, W. A.: Control of Insects. In Medical Department, United States Army. Preventive Medicine in World War II. Volume II. Environmental Hygiene. Washington: U.S. Government Printing Office, 1955, pp. 209-211.

<i>Commissioned</i>		<i>Number</i>
Colonel, Medical Corps		1
Lieutenant Colonels, Medical Corps		2
Lieutenant Colonels, Sanitary Corps		2
Major, Medical Corps		1
Majors, Sanitary Corps		2
Captains or Lieutenants, Medical Administrative Corps		2
Total		10
<i>Enlisted</i>		
Staff Sergeant		1
Technician, 3d Grade		1
Sergeant		1
Technicians, 4th Grade		2
Corporal		1
Technicians, 5th Grade		4
Privates, First Class		2
Privates		2
Total		14

Col. Charles G. Souder, MC, who had taken a leading part in initiating plans for the school's establishment, was named commandant. Lt. Col. (later Col.) John E. Elmendorf, Jr., MC, commissioned for the purpose, was in charge of professional instruction, as he had been for the Florida training course. Four other officers completed the faculty, which included a parasitologist, an entomologist, and two engineers. Combined experience of this staff included not only North and South America but also the Pacific, Mediterranean, and Middle East theaters.

The command problems, which necessitated coordination with high echelons of other branches of the service, involved in establishing the school, setting up the program, and obtaining staff and equipment required 6 months to solve. It was only through the constant and aggressive action of The Surgeon General that the school was finally activated as early as February 1944.

Curriculum.—The course of instruction had been discussed in the Surgeon General's Office in both the Preventive Medicine Division and the Training Division, and it was decided to utilize the program of the Florida school with some modifications. Field work that had not been possible in Florida was added to the curriculum, and it was planned to devote the last week of the course to practical field work in control and survey methods (tables 2 and 3). Laboratory and other technical equipment was requisitioned to be available for the opening of the school, originally scheduled for 1 January 1944.

Each course was to be of 4 weeks' duration, with a 2-week interval between each class. A maximum of 25 officers and eight survey or control units were to be taught in each class.

TABLE 2.—*Summary of training prescribed by Mobilization Training Program 8-21, dated 4 May 1943, for malaria survey units*

Subject	1st week	2d week	3d week	4th week	Total hours
	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	
Entomology.....	12			2	14
Parasitology.....	4	9	8	9	30
Malariology.....	8			2	10
Planning and control.....	8	3	1	3	15
Survey equipment.....	6	5	10	9	30
Field trips.....	2	19	21	13	55
Safeguarding information.....	1				1
Examination, inspection.....		3	2	4	9
Dismounted drill.....				3	3
Physical training.....				3	3
Total.....	41	39	42	48	170

TABLE 3.—*Summary of training prescribed by Mobilization Training Program 8-21, dated 4 May 1943, for malaria control units*

Subject	1st week	2d week	3d week	4th week	Total hours
	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	
Entomology.....	8			1	9
Malariology.....	8			2	10
Planning and control.....	8		2	1	11
Field trips.....	4	19	20	21	64
Safeguarding information.....	1				1
Methods of control.....	8	9	9	6	32
Mosquito control appliances.....	4	9	7	8	28
Dismounted drill.....				3	3
Physical training.....				3	3
Examination, inspection.....		4	4	3	11
Total.....	41	41	42	48	172

The first week was largely devoted to lectures and demonstrations on the basic principles of malariology, parasitology, entomology, and engineering, and their interrelationship in the field of malaria control. There was same introductory field work in basic engineering and in entomology.

During the second week, both officers and enlisted men were trained in laboratory techniques, identification of malarial parasites, and of the adult and larval stages of anopheline vectors. Lectures and demonstrations of individual protective measures such as repellents, aerosol insecticides, and clothing were interspersed with the laboratory work. More field work and concentration on particular specialties was also arranged.

By the third week, the students were ready for detailed and technical aspects of control. Mosquito proofing of various types was explained and carried out, and a splenic and blood survey of a village was made and studied (fig. 3).

The final week of the course was spent in surveying an assigned area and formulating plans for temporary, semipermanent, and permanent occupancy. Students were grouped according to their specialties. This activity served not only to test their abilities but also to emphasize the complementary relationship of the different phases of malaria investigation and control and to crystallize into complete understanding the concepts of malariology and malarial control.

Achievements of the school.—The Army School of Malariology was of basic importance in the malaria control program, which to a great extent depended on it for training personnel. The school was unique in that it was established to meet a desperate military need and had to be activated quickly in an area that presented many problems of transportation and logistics.



FIGURE 3.—Enlisted entomological technicians collect mosquito larvae during a course conducted at the Army School of Malariology, Fort Clayton, C.Z. (U.S. Army photograph.)

It represented a significant achievement in the preventive medicine program of the Army, not only as it served the immediate necessity, but also in its possibilities for long-term postwar planning.

In all, 16 courses for officers were completed during the war. Between October 1944 and June 1945, six 4-week courses were given for enlisted malariology laboratory technicians as the final phase of their training for duty with malaria survey and control units. Plans to send complete malaria units to the Army School of Malariology were largely defeated by transportation difficulties and the restriction on activation in advance of actual demand from the theaters of operations. Two control units only, composed of Puerto Rican personnel, attended the school en masse in July 1944.

The officer registrants came from replacement pools and other commands of the Army Service Forces, Army Ground Forces, and Army Air Forces. The Caribbean Defense Command and Headquarters, U.S. Army Forces in the Middle East, were also represented. In addition, trainees were accepted from the U.S. Public Health Service, the British and Canadian Armies, the Royal Canadian Air Force, and the Royal Netherlands Indies Forces. A few civilian physicians from Latin America were also registered.

Malaria Discipline

Although malaria was endemic in the Southern United States, by 1940 in most of the permanent Army installations it was effectively controlled by the standard means of spraying, draining, filling, and larviciding. However, even when the same procedures were followed in malarious areas in fixed camps overseas, control was not immediately achieved. Temporary camps and field operations presented far more serious hazards, especially in the many regions where both the mosquito vectors and the infected local inhabitants were in close proximity to the troops. For example, in both the Sicilian and the early New Guinea Campaigns there were more malaria cases than battle casualties. By 1943, the military significance of the disease was apparent to all, and it was clear that not only must the environmental sanitary procedures be extended, but also that the individual soldier must be taught to protect himself against the disease, and that military authority must compel him to do so.

War Department Circular No. 223, dated 21 September 1943, which gave the weight of official policy to many other recommendations for malaria and tropical disease control emanating from the Preventive Medicine Service, required also antimalaria training for the rank and file of the Army in the Zone of Interior and overseas. A course of 4 hours was prescribed as the minimum time to be allotted for instruction in malaria control and discipline to all officers and enlisted men. Applicatory experience was to be given in the field, with supplies and equipment made available for the purpose. Refresher classes for all were required before advance

into malarious areas.¹⁶ A detailed program of instruction to meet this training requirement was published as War Department Training Circular No. 108, dated 21 September 1943.

Not only announced policy but also bitter experience gradually began to be rewarded by improved rates. In some tropical areas, troops were given antimalaria indoctrination almost immediately on arrival and during movement to destination. Some commanders required that the 4 hours' training for all members of the U.S. forces be repeated every month.¹⁷

Special Units for Malaria Control

Discussion of malaria and tropical disease control is not complete without additional comments on the two new types of antimalaria units developed during the war—the malaria control unit and the malaria survey unit. Colonel Russel, an eminent malariologist of the Rockefeller Foundation, was brought into the Surgeon General's Office early in 1942 to advise on the problem of malaria. From years of experience in Europe, Africa, and Asia, and from an extensive knowledge of the British Army and colonial civil experience with this disease, Colonel Russell was convinced that conventional measures would never give commanders the degree of control necessary to keep susceptible U.S. troops effective while fighting in unsanitized tropical areas. It was his conviction that a special type of control organization would be necessary and that a medical malariologist should be given extraordinary authority in planning and executing malaria control in such areas. The peculiar and special organizations needed were (1) a scientific diagnostic laboratory, and (2) a trained organization to supervise and carry out control measures. These units came to be known as malaria survey units and malaria control units.

There was considerable opposition at home and overseas, and among both medical officers and commanders, to the creation of such special units, and it was not until the wisdom of giving unusual attention to malaria had been demonstrated in combat that full acceptance was obtained. A brief summary of the organization and training of these units follows.

Malaria survey units were composed of one commissioned entomologist, one commissioned parasitologist, and 11 enlisted men. The equipment was that necessary to operate a small mobile entomology laboratory with the required transportation. This type of unit was designed to collect, examine, and identify mosquito specimens; to make, stain, and examine blood smears; and to facilitate accurate clinical diagnoses from referred blood slides and other specimens.

¹⁶ (1) Army Regulations No. 40-205, 31 Dec. 1942. (2) Army Regulations No. 40-210, 15 Sept. 1942. (3) War Department Field Manual 21-10, Military Sanitation, July 1945. (4) War Department Field Manual 8-40, Medical Field Manual: Field Sanitation, 15 Aug. 1940.

¹⁷ (1) War Department Technical Bulletin (TB MED) 182, July 1945. (2) Memorandum No. 58, Headquarters, Americal Division, dated 20 Oct. 1943.

Malaria control units were composed of a commissioned sanitary engineer and 11 enlisted men. The equipment consisted of that required for minor draining and filling, for larviciding and spraying operations, and for the transportation necessary to give mobility to the unit.

Upon the request of The Surgeon General on 28 December 1942, six malaria survey units and 15 malaria control units were activated at the Services of Supply Unit Training Center, New Orleans, La. This training site later was to become known as Camp Plauche.

Camp Plauche offered nearly ideal field conditions for the training of antimalaria units. The climate was semitropical and year-round training activities were feasible.

It was the general plan to organize malaria survey units and malaria control units from enlisted personnel of the Medical Department who had already received their basic training, so that the 4-week period allotted for specialty training could be devoted entirely to instruction in the skills such personnel would require in their overseas assignments. In many instances, however, enlisted personnel with no previous training of any type were assigned to these units. Also, it had been hoped that an adequate number of enlisted men with previous experience in entomology, mosquito control, and related fields would be available. Such was not the case, and the enlisted students sent for unit training frequently were deficient in basic technical preparation.

Other serious handicaps to training were encountered. Because of crowded conditions in the area, tents were used as classrooms. They were highly unsatisfactory because of the intense heat in that locality and because some areas of the camp were below sea level. Torrential rains often made it impossible to utilize the tent classrooms. Training was interrupted to an inordinate extent by the need to use the trainees to correct the sad physical state of the camp. This involved weedcutting, ditchdigging, construction of duckboards, sidewalk building, and many other details which perhaps should not have been the responsibility of training units.

The officer personnel assigned to the newly activated malaria survey and control units generally were those who had had previous mosquito control or sanitary engineering experiences in civilian life or who had been specially selected by The Surgeon General to undergo the required training in malariology and related fields for assignment to such units. Those officers with previous experience as sanitary engineers, parasitologists, malariologists, and even as sanitary technicians, were well grounded and performed acceptably. The same is true of those individuals trained by the U.S. Army for assignment to antimalaria units. Equipment for the units in training generally presented no problem.

A training program was prepared by the Medical Department personnel at the Unit Training Center, Camp Plauche. It met with the approval of The Surgeon General and was utilized until MTP (Mobilization Training

Program) 8-21, "Medical Department Training Programs for Malaria Survey Units and Malaria Control Units," was published on 4 May 1943 (tables 2 and 3).

One serious restriction, resulting from shortsighted policy, was placed upon The Surgeon General. He was not allowed to put into effect a serviceable plan for "preactivation training" of these units. He was prohibited from organizing an antimalaria unit to replace one that had been shipped overseas until a request for such a unit had been received from an active theater. This resulted in a long delay while personnel were obtained, sent to the training center, given their 4 weeks of training, processed for overseas movement, and eventually shipped to the requesting theater. At least one theater, China-Burma-India, solved the difficulty by activating control units within the theater and by staffing them with men who were already in the area.¹⁸

As the need for antimalaria units in overseas theaters became more pressing, The Surgeon General recommended to the Commanding General, Services of Supply, on 1 March 1943, that—

1. There be activated a sufficient number of such units to meet the demands of overseas theaters.

2. Immediate training of such units be initiated so that they would be prepared for functional employment upon arrival overseas.

3. As units were shipped to overseas theaters, additional units be activated in accordance with recommendations of The Surgeon General until such time as it appeared likely that no further need for such units existed.

4. A minimum of 1 month's training subsequent to completion of basic training be adopted for the enlisted personnel before functional employment.

In general, these recommendations were approved, and authorization was given for immediate activation of 10 survey and 15 control units.

From its beginning in 1943 to 1 September 1945, a total of 75 malaria survey units and 151 malaria control units were activated and trained in Camp Plauche and in Panama. In addition, a large number of units were activated locally in the overseas theaters and were put to work where malaria was a problem.

There can be no doubt that the concept of malaria control as developed and fought for by the Preventive Medicine Division of the Surgeon General's Office was the key to the eventual control of malaria as a military problem. Commanding officers whose slogan was "fight the enemy, not the mosquito" at first found it difficult to conceive of malaria as a problem that could not be handled as a routine medical problem, and the dedication of troops and officer specialists to the single task of fighting this disease

¹⁸ Letter, Commanding General, China-Burma-India Theater, to The Surgeon General, U.S. Army, 31 May 1943, subject: Malaria.

seemed unnecessary until entire divisions were immobilized. Since the malaria units were not under their operational control but were attached only for logistic support, some medical officers looked with suspicion upon this engrafting of special organizations upon their own preventive and sanitary organizations as an infringement upon their responsibilities and authority, if not an affront to their professional competence. However, the objections disappeared rapidly as the lessons of malaria wastage under haphazard systems of control were learned. In the last year of the war, malaria in endemic areas was under effective control—an achievement that seemed impossible in 1941 and 1942. Malaria suppression through the use of Atabrine (quinacrine hydrochloride or mepacrine hydrochloride), chloroquine, and other related compounds was a key factor, and the story of its development is a brilliant chapter in the history of medical accomplishments under the pressure of wartime necessity. The acknowledged success of the special unit approach to a single disease such as malaria permitted the development of the concept of the preventive medicine team which will, it is hoped, remain in medicomilitary doctrine ready to be expanded as needed to meet future crises.

MEDICAL SANITARY COMPANIES

The majority of the medical sanitary companies were activated in 1942 and 1943, although at least six had been activated by July 1941.¹⁹ The company consisted of three officers and approximately 118 enlisted men, according to Table of Organization No. 8-117, dated 1 April 1942. The men were given the regular basic training courses at Medical Replacement Training Centers and MTP 8-1, dated 18 February 1942, was used as a guide. This was a general program for the balanced training of all Medical Department units. Toward the end of their course, the sanitary companies were given particular indoctrination in malaria control using MTP 8-10, dated 1 July 1944.

These units were designed to be employed in and about hospitals on various tasks assigned by the hospital commander. They were limited to one company and to a general or station hospital of over 1,000 beds.

Sanitary companies assigned to the Pacific theaters were used more specifically for mosquito and insect control work than in other areas. They drained swamps, spread oil and larvicides, and also maintained water purification and sewage facilities. In the European theater, the companies were rarely used for malaria control, but were put to various tasks by the local commanders. A large number were employed as stretcher bearers, especially in ports and evacuation centers. Other units remained in the United States and were utilized as ward orderlies and general labor forces.

¹⁹ The Army Medical Bulletin No. 57, July 1941.

TRAINING OF ENLISTED PERSONNEL

Carlisle Barracks

The only course for enlisted personnel at the Medical Field Service School before World War II was the Noncommissioned Officers Course. This course had been conducted for the first time in 1924 and was still an element of the program of the school in 1940.²⁰ It was an 8-week course designed "to perfect the students in basic military and technical subjects and to teach correct and effective methods of instruction and the art of handling and training Medical Department troops in the components of the Army of the United States."²¹

In fiscal year 1940, the Noncommissioned Officers Course included instruction in company administration, responsibilities and techniques of military leadership, logistics, tactical employment of Medical Department units, map reading, sanitation, control of communicable diseases, first aid, and teaching methodology.²²

This training program was adjusted to peacetime needs. In fiscal year 1940, The Surgeon General's Protective Mobilization Plan for 1939 (15 December) was issued to provide a general outline of the directions in which the peacetime program of school-level training for enlisted personnel of the Medical Department would be expanded in the event of a national emergency. This plan indicated that the Medical Field Service School would be utilized primarily for the training of officer candidates and commissioned personnel. It was anticipated, however, that in the event of mobilization, a course for enlisted sanitary technicians would be inaugurated at the school.

The Medical Field Service School did initiate such a course in fiscal year 1941, and it continued to conduct the Noncommissioned Officers Course in both 1941 and 1942. In October 1942, the course was discontinued, and 1 month later the responsibility for training sanitary technicians was transferred from the Medical Field Service School to the various Medical Replacement Training Centers.

The Sanitary Technicians Course which had been anticipated in The Surgeon General's Protective Mobilization Plan for 1939 was inaugurated on 9 September 1940. The course, which lasted 1 month, included 156 hours of scheduled instruction allotted as follows:²³

²⁰ Report of The Surgeon General, U.S. Army. Washington: Government Printing Office, 1924.

²¹ Technical Report of the Activities of the Medical Field Service School, Carlisle Barracks, Pa., 6 Sept. 1940, p. 6.

²² Instructional Matter, Noncommissioned Officers Course, 1939, Medical Field Service School, Carlisle Barracks, Pa., 6 Sept. 1940, p. 6.

²³ Goodman, Samuel M.: A Report of the Schooling of Enlisted Personnel, Medical Department, vol. IV, 1 July 1939-30 June 1944. [Official record.]

<i>Subject or activity</i>	<i>Hours</i>
Control of respiratory diseases	5
Control of insectborne diseases	28
Control of intestinal diseases and disposal of waste	14
Water sterilization and purification	16
Military sanitary devices	9
Control of venereal diseases	2
Disinfection	1
Food and mess inspection	10
Sanitary surveys and reports and vital statistics	12
Immunization and vaccination	3
Personal hygiene	1
Selection of campsites	3
Assigned reading and practical work	16
Drill calisthenics, inspections	16
Military courtesy	3
Mapreading	1
Open time	3
Examinations	7
Processing	6
Total	156

The relative emphasis upon different educational procedures in the Sanitary Technicians Course is indicated in table 4.²⁴

TABLE 4.—*Relative emphasis upon different educational procedures in the Sanitary Technicians Course*

Educational procedure	Hours allotted to method	Percentage of time allotted to method
Conference.....	43	27.6
Demonstration.....	27	17.3
Applicatory exercise.....	68	43.6
Examination.....	11	7.0
Open time and time reserved for processing.....	7	4.5
Total.....	156	100.0

Medical Replacement Training Centers

In World War II, the training of Medical Department enlisted men in sanitation and preventive medicine subjects is best visualized by an examination of the wartime MTP 8-1. The written program dated 18 February 1942 shows a prescribed training period of 13 weeks divided as follows:

Basic period.—Training during the first and second week included 5 hours of personal hygiene, sanitation, and first aid for all men.

²⁴ See footnote 23, p. 30.

Technical period.—From the 3d to the 10th week, inclusive, training of the individual enlisted man continued, but emphasis was placed upon basic technical subjects that would fit the enlisted man for actual practice or further training in a medical unit or installation. In addition, specialist (common or administrative specialties) training and tactical and logistical training was begun.

Tactical period.—The 11th through the 13th week was chiefly devoted to field and applicatory exercises. Generally, personnel intended for professional units or installations were able by this time to qualify as ward attendants or to have sufficient technical knowledge to function as basic sanitary technicians (fig. 4).

The technical training for men selected for sanitary technicians (junior) was given in the fifth to the eighth week and comprised a total of 144 hours (table 5).

Table 6 shows the wartime total of enlisted trainees in "common specialties" and indicates the relative number of sanitary versus other



FIGURE 4.—A small, but well designed, sanitation demonstration area at Camp Carson, Colo. (U.S. Army photograph.)

TABLE 5.—*Technical training for men selected for sanitary technicians (junior)*

Subject	5th week	6th week	7th week	8th week	Total hours
	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	
Basic principles of military sanitation	7				7
Control of respiratory diseases and housing	9				9
Foodborne disease of the intestinal tract and mess sanitation	14				14
Water treatment purification	6	18			24
Disposal of wastes		18	16		34
Insectborne disease and control of insects			20	8	28
Control of venereal diseases				3	3
Mass physical examinations and mass immunizations				4	4
Sanitary surveys, reports and orders				11	11
Vital statistics				10	10
Total	36	36	36	36	144

TABLE 6.—*Common specialists trained at Medical Replacement Training Centers, 1941-45*

Specialties	1941-42	1942-43	1943-44	1944-45	Total
Clerks	3,143	11,443	5,172	3,894	23,652
Cooks and bakers	2,794	7,313	3,365	2,140	15,612
Mess sergeants	52	1,379	485		1,916
Medical and surgical technicians (basic) ¹	769				769
Sanitary technicians ²		2,216	1,104	643	3,963
Veterinary technicians and meat and dairy inspectors ³		1,840	459	99	2,398
Automobile mechanics	805	1,770	862	460	3,897
Truck drivers, heavy	2,640	835	12		3,487
Truck drivers, light	4,263	14,761	2,910	2,046	23,980
Chauffeurs	41	21			62
Motorcycle drivers	108				108
Motor transport noncommissioned officers		29	2		31
Dispatchers		15	1		16
Buglers		348	126	86	560
Total	14,615	41,970	14,498	9,368	80,451

¹ The medical and surgical technicians produced at Medical Replacement Training Centers received 6 weeks' training, whereas those trained in Medical Department Enlisted Technicians Schools received 12 weeks' training. Differences in level of training was indicated in the graduates' classification records.

² Sanitary technicians were trained at the Medical Field Service School until fiscal year 1942 when the Sanitary Technicians Course was removed to centers.

³ The same 6-week course was given to both veterinary technicians (SSN250) and meat and dairy inspectors (SSN120) who were trained at center level. Assignment of a specification serial number depended upon utilization of the graduate. Courses of 12-week duration in veterinary subjects were given in two Medical Department Enlisted Technicians Schools. Graduates from the school-level courses were also designated as veterinary technicians or meat and dairy inspectors. Differences in level of training was indicated in the graduates' classification records.

Source: Goodman, Samuel M.: A Summary of the Training of Army Service Forces Medical Department Personnel, 1 July 1939-31 December 1944. [Official record.]

types of specialties given in Medical Replacement Training Center training during 1941-45.

The tabulation that follows shows by way of comparison with table 6 the extent and number of enlisted technicians trained in various Medical Department schools and courses, during 1940-45. Table 7 gives further evidence of the intensive and varied training of enlisted technicians of the U.S. Army Medical Department who obtained specialist training at the nine general hospitals and the Army Medical Center during 1940-45.²⁵

<i>Schools and courses</i>	<i>Number</i>
Medical Department Enlisted Technicians Schools	114,839
Army School of Roentgenology (X-ray technicians)	953
St. Louis Medical Depot (equipment maintenance)	1,092
St. Louis Medical Depot (optical technicians)	195
Station Hospital, Fort Huachuca (5 specialties)	111
Replacement Training Centers (veterinary technicians)	2,588
Replacement Training Centers (sanitary technicians)	4,495
Medical Field Service School (sanitary technicians)	712
Orthopedic technicians	569
Physical reconditioning instructors	846
Women's Army Corps occupational therapy technicians	265
Women's Army Corps physical therapy technicians	402
Special Women's Army Corps medical and surgical technicians course (Fort Oglethorpe)	4,969
Total	132,123

Health and Sanitation Training for the Combat Soldier

Before World War II, troops of all arms and services were given instruction in personal and social hygiene, first aid, and physical training as directed by AR (Army Regulations) 40-205, "Military Hygiene and Sanitation," dated 15 December 1924. It was realized that these subjects were essential in maintaining health and developing the strength and endurance by which the soldier could perform his duties under the stress and hardships of combat. In 1939, 5 hours of training time were devoted to personal hygiene and first aid. By July 1941, this was increased to 5½ hours.²⁶ Under the impetus of the early experiences in combat, this time was further extended. MTP 21-1, dated 1 March 1943, shows that 3 hours were devoted to these subjects during the first 4 weeks of the basic training course for all enlisted men of the Army Ground Forces (fig. 5). An additional 8 hours was given to first aid. The breakdown for the 3 hours of instruction in military sanitation and sex hygiene is as follows:

²⁵ Medical Department, United States Army. Training in World War II. Chapter VI. Training of Enlisted Technicians. [In preparation.]

²⁶ War Department Field Manual 21-5, Basic Field Manual: Military Training, 16 July 1941.

<i>Lesson number</i>	<i>Subject</i>
1 (1 hour).....	Sex hygiene.
2 (1 hour).....	Personal hygiene, general care of mouth, skin, clothing, constipation; care of feet; messkit sanitation.
3 (1 hour).....	Military sanitation: Field water supply, demonstration of water chlorination, disposal of various wastes, insect control and field expedients.

The required instruction in military sanitation and sex hygiene was subsequently increased again by 8 hours, and MTP 21-4, dated 10 March 1945, shows a total of 11 hours devoted to these subjects during the first 5 weeks of the 17-week basic training course for all nonmedical enlisted men. This is evidence of the new appreciation of the importance of preventive medicine which had developed during 1943, 1944, and 1945.

Training was to be given in accordance with War Department Circular No. 223, dated 21 September 1943, and War Department Training Circular No. 108, dated 21 September 1943. To meet the minimum standards of proficiency as described in War Department Circular No. 48, dated 3 February 1944, it was necessary that training in these basic medical subjects be given all enlisted personnel. If any subjects were not covered during the regular training cycle, they were to be made up at night, during makeup and review periods, or concurrently with other training.

The emphasis on preventive medicine in War Department Circular



FIGURE 5.—A combined lecture-demonstration for U.S. Army troops in the military sanitation area of Camp Robinson, Ark.

TABLE 7.—Technicians trained in Medical Department Enlisted Technicians Schools, 1940-45

Location	Technician courses								Total
	Medical	Surgical	Advanced Medical and Surgical	Dental	Laboratory	X-ray	Pharmacy	Veterinary	
Army Medical Center.....	2,205	2,078	362	778	817	498	407	669	7,814
General Hospitals:									
Army and Navy.....	1,270	718		250	257	302	201		2,998
William Beaumont.....	5,031	6,804	280	972	550	484	701	868	15,690
Brooke General.....	4,844	4,619	320	698	589	433	426		11,929
Fitzsimons.....	9,364	10,685	368	2,386	1,774	1,855	667		27,099
Letterman.....	1,994	1,615	110	341	213	239	114		4,626
Billings.....	3,777	5,002	307	1,326	1,384	1,094			12,890
Lawson.....	4,529	6,208	326	1,423	1,553	1,130			15,169
O'Reilly.....	3,210	6,105	366	1,993	1,324	1,223			14,221
Wakeman.....	931	706		287	360	119			2,403
Total.....	37,155	44,540	2,439	10,454	8,821	7,377	2,516	1,537	114,839

No. 48 reflects the contribution which was being made to the training effort by the Preventive Medicine Division. The duties of the command surgeon and his relation to the commanders are clearly defined, as well as the final responsibility of all commanders to maintain the health of their units:

* * * * *

* * * It is the responsibility of unit commanders of all echelons to preserve the fighting strength of their units by maintaining the health of their men, and the degree to which this is accomplished is a measure of their leadership * * *. The unit surgeon is a staff officer of essential importance. He is not provided for the sole purpose of administering to the sick and injured. His primary responsibility is to advise his commander how the personnel of the command can be kept physically and mentally well. His duties include the preparation and supervision of adequate health training programs * * * submission of recommendations as to proper preventive measures and sanitary regulations * * *.

* * * * *

War Department Circular No. 48 established minimum standards of proficiency to be attained by enlisted and officer personnel. It provided a guide for a 33-hour program for enlisted personnel (20 hours of instruction in sanitation, 10 hours in first aid, and 3 hours in personal adjustment—the latter being a preventive psychiatry program). It also provided a guide for a 26-hour program for all officers and noncommissioned officers (12 hours in sanitation, 8 hours in first aid, and 6 hours in personal adjustment).

By way of illustration, the following paragraphs summarize the more important aspects of this mobilization training program:

Malaria control.—Of the 11 hours allotted, 5 hours were devoted to this subject. The objective was to teach the soldier the urgent necessity for proper control of this disease and hence the need for strict malaria discipline. It was to be stressed that malaria put more men out of action than did enemy bullets. Soldiers were to be taught the correct use of anti-malaria protective measures—screening, bednets, larvicides, protective drugs, and drainage and filling. Training Films 8-953 and 1-3343 entitled “Malaria, Cause and Control” and “Malaria Discipline,” respectively, were to be shown, as well as Graphic Training 8-14, “Malaria.” The use of world maps showing infected areas was recommended.

Personal and sex hygiene.—The trainee was to be instructed in practical measures necessary for the conservation of health and for the maintenance of physical fitness such as the care of the skin, nails, hair, mouth, and feet, with special emphasis on trenchfoot; the need for regular habits; and the rules to be followed in the field to avoid disease. The importance of sex hygiene was to be stressed, and methods of preventing venereal disease—prevention of exposure and use of prophylactic measures—were to be taught. Training Film 8-2060 entitled “Pick Up” was to be shown to all trainees, and additional training aids were to be used whenever time and circumstances permitted.

Field sanitation.—The aim of this program was to teach the trainee the use and importance of sanitary expedients in the maintenance of his own physical health and that of others in the field. Instruction included subjects such as the proper cleaning of messkits; proper disposal of human waste; and the construction of such field installations as latrines, showers, fire trenches, incinerators, and delousers. This instruction was to be correlated with that in malaria control, diarrhea, dysentery, and respiratory diseases. The seriousness of scrub typhus fever and measures for its prevention by the individual soldier were to be explained in areas where it occurred. Teaching was to be accomplished by means of a sanitation demonstration area where the most common field installations as contained in Field Manual 8-40 were shown. Practical exercises in field sanitation were to be conducted in connection with subject matter "marches and bivouacs" in the last week of training. Films also were to be shown in this subject.

Training Overseas

As the areas of military activity extended throughout the world, training was in continuous operation in the field and on the bases. As particular problems came into prominence such as malaria, venereal disease, cold injury, or typhus fever, special training efforts were made on the scene in all theaters to contend with them.

In February 1943, a Field Service School was established at Shrivenham, England. Here, a 1-month course was given in field methods of medical practice in which preventive medicine procedures were included. Among many courses, a special one in typhus fever control was developed and given to representatives of units then stationed in the United Kingdom. Those who took this course included line officers and members of the Quartermaster Corps as well as the Medical Corps. Thus, information was passed on to troops before they embarked for the Continent where typhus was known to present a serious threat. Further training was given in the subject as the armies advanced toward Germany. Later, the Field Service School was transferred to Étampes, near Paris.

The British Post-Graduate Medical School gave courses in war medicine which were attended by many American and Canadian officers, a number of whom also served on the faculty.²⁷

TRAINING AIDS

Before 1939, the use of training aids in the U.S. Army Medical Department, other than by the Medical Field Service School, was not extensive. As the Army began to expand, however, it was clearly necessary to

²⁷ Gordon, John E.: *A History of Preventive Medicine in the European Theater of Operations, U.S. Army, 1941-45*, vol. I, pt. III, p. 6. [Official record.]

develop new and up-to-date training material in all fields. The problems inherent in the teaching of the enormous numbers of men by the comparatively few experienced instructors necessitated the creation of different techniques. Furthermore, a new approach was needed to be effective in this citizen army. The authoritative, legalistic attitude of Regular Army training was replaced by procedures which were designed to stimulate the individual soldier, somewhat in the manner of an advertising campaign, to accept responsibility for his own and his comrades' health. As the size of the U.S. Army increased and the war was extended both in time and in geographic territory it also was necessary to provide continuing and additional education in health subjects; lessons once learned had to be repeated so that they were not forgotten under changing conditions (fig. 6).

The traditional manuals, lectures, and demonstrations were, therefore, supplemented by new training aids. Films were used extensively. Short, propaganda-type films, filmstrips, and cartoons were prepared. Posters and popularly styled pamphlets were written, and other devices such as

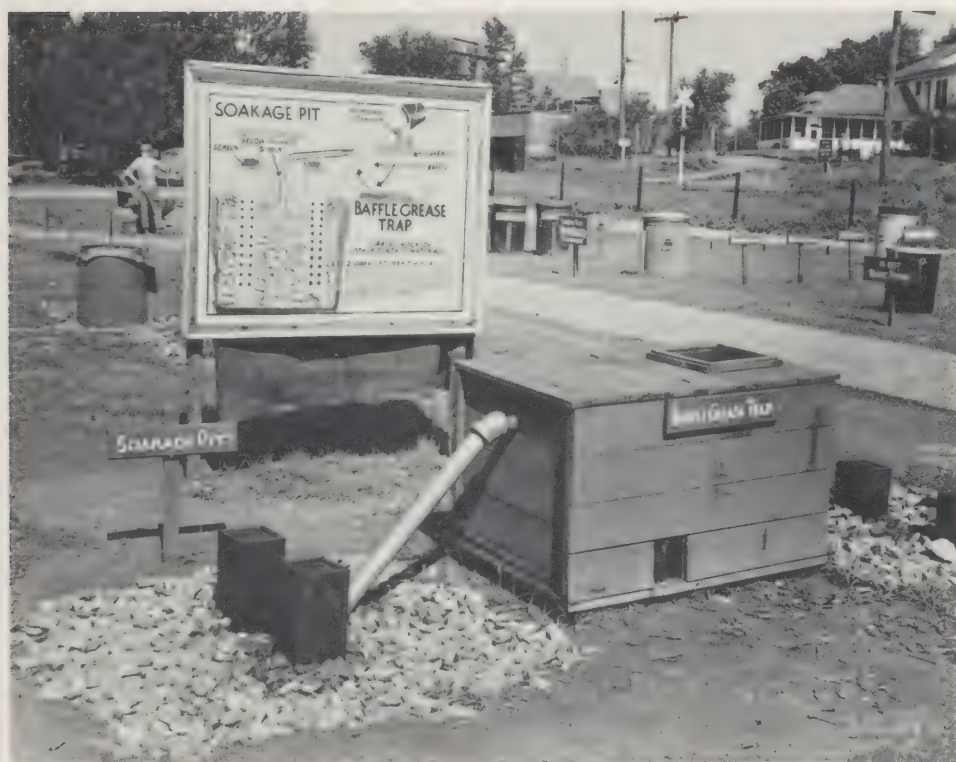


FIGURE 6.—Training aids used in the military sanitation area, Medical Field Service School, Carlisle Barracks, Pa.

matchbook covers and ration wrappers were used to remind individuals of the dangers and of their own responsibilities.

Thus, during World War II, health education became a new field which differed in approach and methods from the strictly training procedures. In January 1945, the several educational activities in the branches of the Preventive Medicine Service were assembled into one unit, the Health Education Unit. This unit also worked in close cooperation with the Training Division of the Surgeon General's Office (pp. 85-99).

Venereal Disease

Training aids for venereal disease originated in the Venereal Disease Education Section of the Venereal Disease Control Division, Preventive Medicine Service. The first film on the subject, TF (Training Film) 8-154, "Sex Hygiene," was prepared and distributed in 1940 to supplement the lectures which were required by AR 40-235, "The Prevention of the Communicable Diseases in Man—Venereal Diseases," dated 11 October 1939. It was accompanied by a pamphlet with the same title. Later, both were revised. In 1942, a film prepared for civilian use by the U.S. Public Health Service entitled "Know for Sure" was widely used in the Army. As more men were sent overseas, another pamphlet, "Venereal Disease Overseas," was distributed at all ports of embarkation. When AR 40-235 was rescinded in September 1942 and replaced by AR 40-210, "Prevention and Control of Communicable Diseases in Man," dated 15 September 1942, the section on venereal disease education was not sufficiently specific, so, in March 1943, War Department Training Circular No. 28 was published. This defined a program for use at replacement training centers and induction stations of the various training aids. It included the pamphlets "Off to a Good Start," "It Doesn't Pay," and "Sex Hygiene"; TF 8-154; and three filmstrips (8-57, 8-58, and 8-59) with notes to aid instructors and lecturers.

By January 1943, posters were being distributed to appeal to the average age and intellectual level of the troops. Some of these posters were prepared in the War Department, others were acquired through the American Social Hygiene Association; Wyeth, Inc., pharmaceutical manufacturers; and the Zachary Smith Reynolds Foundation, a philanthropy of the Reynolds Tobacco Company.

In 1944, two more pamphlets, "So You've Got a Furlough" and "You Don't Think," were published and TF 8-2060 entitled "Pick Up" released. This was a welcome change from the original TF 8-154, which was becoming too familiar to the troops to convey its message effectively.

Matchbook covers were first used to carry venereal disease information. Late in 1943, they were issued in specific areas, with slogans and lists of prophylactic stations. This device was used subsequently in other preventive medicine fields.

Malaria and Other Tropical Diseases

The training of professional and technical specialists in tropical disease control has been discussed previously. However, as more and more men were moved into areas where tropical diseases were endemic they needed to be taught the approved preventive methods which could only be applied by the individual soldier. Most of these diseases, including malaria, were unfamiliar to Americans, and their devastating effect was all too often learned by bitter experience. In January 1944, when the Tropical Disease Control Section was separated from the Epidemiology Branch to become a division, an Education Branch was established in it. Its purpose was to initiate informative material for both specialized and general personnel which would supplement the purely didactic instruction.

Before this time, in the summer of 1943, a booklet entitled "This is Ann," prepared by Maj. Munro Leaf and the cartoonist Theodor S. Geisel (Dr. Seuss), was published and distributed to troops proceeding to tropical theaters. It carried information on the *Anopheles* mosquito and malaria control and was a successful variation from the traditional approach. From its illustrations, posters were developed and used on the reverse side of the "newsmaps" which were circulated by the Information and Education Division of the Army.

Training Film 8-953 was made and distributed early in 1943. This was supplemented in 1944 by TF 1-3343 in which both command and individual responsibility for preventive measures were stressed. Two animated cartoon motion pictures were produced by the Morale Services Division, Army Services Forces, as part of the "Private Snafu" series. Another film for use in practical training of personnel in malaria control, Film Bulletin 200, "Malaria Control on Corsica," was made on that island. Twenty cartoon strips emphasizing individual measures for malaria control were made to be shown before feature motion-picture films and were highly effective.

A series of 15 posters and a number of windshield stickers, carrying slogans such as "Shorten the War—Prevent Malaria," were made. Other devices were records for use on local radio networks, matchbook covers, and ration box wrappers. Graphic portfolios, measuring 30 by 40 inches, were prepared to support formal instruction in tropical diseases and personal hygiene.

As soon as it was realized that schistosomiasis was presenting a severe problem on Leyte in the Philippine campaign, two films were produced. The first (Miscellaneous Film 1230, "Schistosomiasis") was a short description of the geographic distribution, epidemiology, clinical aspects, and control methods of the disease; the second film was a fuller and more technical version of the same subject. Although these films were begun earlier, they were not completed until the war in the Pacific was over.

The Health Education Unit prepared a series of posters ready for

use by troops being redeployed to the Pacific area early in 1945. There were three posters on schistosomiasis, four on scrub typhus, and others on plague, filariasis, and malaria.

Cold Injury

When the epidemic of trenchfoot reached serious levels during the winter of 1943-44 in Italy, plans were initiated for educational and training material on the subject. A film entitled "Personal Health in Operations in Snow and Extreme Cold" was released in December 1943, but it was not aimed at trenchfoot. There was an urgent need for a training film specifically directed toward this complaint and its prevention. Film Bulletin 180, "Trench Foot," was authorized in September 1944 but was not completed and released until February 1945. It was an excellent and lively production and was of considerable benefit in helping to prevent many casualties.

An educational film was prepared by the photographic section of Supreme Headquarters, Allied Expeditionary Force, for the First U.S. Army, using clinical material from its medical installations, and supervised by its medical officers. Still photographs of preventive procedures were also made in the theater and used for instruction. A poster was prepared in the War Department and another by the Army Ground Forces, Fort Benning, Ga., for use in the European theater. These were supplemented by local efforts, which were not always medically accurate, and therefore of doubtful value.²⁸

Personal Hygiene and Sanitation

To supplement instruction in these areas, films, posters, filmstrips, and other training aids were prepared in the Training Division, Surgeon General's Office, with technical advice and supervision of the various branches of the Preventive Medicine Division. Training Film 8-155, "Personal Hygiene," was designed for use in conjunction with the 1-hour class on the subject in basic training; it demonstrated the rules of personal cleanliness. The Sanitary Engineering Division collaborated in the production of TF 8-1174, "Purification of Water," in 1943. This film showed mobile and portable water purification units, and especially the methods whereby the individual soldier in the field could procure and safeguard his own drinking water. Training Film 8-1179, "Human Waste Disposal," illustrated methods of waste disposal which would avoid water contamination and fly breeding. A number of filmstrips were also prepared on these and related subjects.

²⁸ Medical Department, United States Army. Cold Injury, Ground Type. Washington: U.S. Government printing office, 1958, pp. 73 and 171.

REFLECTIONS AND CRITIQUE

Probably every troop commander was acquainted with the dictum that the primary mission of the Medical Department was to prevent disease and conserve manpower. In practice, this concept was frequently overlooked under the pressure of training and the requirements of the tactical situation. Here, the fault in many instances must be referred back to the staff surgeon who failed to give sufficient prominence to the concept of prevention and all it entails in everyday operations and for men living and fighting under field conditions.

The lessons from past wars as to the military significance of preventable troop wastage is recognized by all thinking military people. Perhaps our failure to adhere tenaciously to sound preventive practices was due in part to a feeling that modern technology and medical care were sufficiently weighty to justify shortcuts and the taking of chances in matters of troop hygiene, sanitary discipline, and environmental control. A good parallel has been seen in recent years in the increase of cross infections in hospitals where, corresponding with the introduction of magic drugs, there has been a weakening of the rigid isolation and sanitary precautions that characterized all good hospitals before the war.

There are instances on record where senior Regular Army medical officers were actually in ignorance of basic facts in the causation of disease. One high ranking medical instructor at an important service school, as an extreme example, in teaching the prevention of the diarrheal diseases, stressed some of the old British Colonial opinions regarding chilling of the abdomen as the causative factor in dysentery, cholera, and diarrhea. Senior commands taking uninitiated U.S. troops into tropical theaters could not be expected to enforce water discipline and latrine sanitation if they believed that the diarrheal diseases were due to temperature factors rather than bacteria and amebae in the food and drink.

Many key surgeons serving in World War II were clinical specialists and were not equally qualified in preventive medicine. They were not fully aware of the role of environment in the causation of diseases. Certainly, few of our medical officers had an adequate concept, initially, of the magnitude of the threat posed by tropical mosquitoes and other insects. When bringing their troops into contact with environmental disease factors, commanders sometimes took it upon themselves to follow erroneous beliefs concerning immunization to disease. One famous U.S. division, while staging for its overseas assignment, experienced a great deal of bacillary dysentery due to neglect of sanitation. This deplorable situation resulted directly from the commander's belief that troops "had to be bloodied by the dysentery before they could take to the field." Other commanders, in the absence of forceful medical guidance, ascribed outbreaks of dysentery to onerous and unpopular programs of Atabrine prophylaxis. These examples

illustrate the point that ultimate responsibility for prevention of disease and conservation of manpower falls upon the commander, since prevention entails the use of military time and labor for duties that might seem unrelated to the primary mission of the unit.

The U.S. Army entered World War II with probably no more than 12 medical officers well trained in modern public health methods. There existed a large reservoir of public health officers in city, county, and State health departments throughout the country. Because of the necessity for maintaining the civilian economy in support of the war effort, the number of such physicians and technical experts who could be taken into the services was limited and proved to be entirely inadequate to meet the military needs.

The training programs described above represent an emergency attempt to correct deficiencies in professional manpower. This effort was on the whole successful, despite the late start and the administrative difficulties which were encountered in developing an adequate corps of specialists to implement the military preventive medicine program.

While training doctrine was prescribed by The Surgeon General through his Preventive Medicine Division and Training Division, there unfortunately grew up a demarcation between the responsibilities of the Surgeon General's Office and the various service commands. While the training doctrine promulgated by the Surgeon General's Office may have been sound, subordinate area surgeons were not always in a position to carry such doctrine into fulfillment, either because of disagreement on fundamentals, or because of command decisions over which the surgeon had no control.

Quotas for the various training classes in preventive medicine were established by the Surgeon General's Office and allotted to major subordinate commands, which, in turn, suballotted them further. All too frequently, for one reason or another—and at times there were sound reasons—full advantage of the training opportunities was not taken, with the result that numerous classes did not meet the capacity of the training installation. In other instances, the same officer attended several different courses, not because he was deserving of the training, but rather because he was the officer most easily spared from his organization. Often the important matter of insuring full quotas at schools and seeing that proper candidates were selected was the responsibility of the various service command surgeons, who could not be expected to weaken their own organizations for the more remote considerations of "the good of the service."

It is unquestionable that The Surgeon General's control over allocated training programs was weakened by such delegation of authority and by his inability to provide sufficient training inspections.

Before events at Pearl Harbor indicated the probable territories of war, there existed in the Surgeon General's Office an inadequate collection

of data dealing with social, medical, and sanitary conditions in the countries and islands that subsequently proved to be theaters of war. The first analyses undertaken in 1939-40 were based upon limited published articles in the lay and medical press. Various organizations also contributed information during this early period. Probably this deficiency will not occur in the future due to the lessons learned during World War II, and the development of an excellent Medical Intelligence Division in the Surgeon General's Office.

In summary, it is believed that there should be unremitting effort to indoctrinate professional officers in the broad concepts and principles of disease prevention, starting with the cadet at the U.S. Military Academy, and going up through the service schools, including the Command and General Staff School, the Army War College, and other schools dealing with military problems on a national and international scale. If all commanders are properly indoctrinated and motivated, the medical program of prevention recommended by surgeons of all echelons will be generally accepted and successful.

World War II proved that it was necessary that the combat soldier receive maximum training in military preventive medicine. The programs of instruction in these areas had increased from 5 hours of instruction in 1939 to 33 hours by 1944.

Professional training in military preventive medicine in all its aspects should become an essential part of the planned training of all career Army medical officers to an even greater extent than in the past. Fundamental doctrines and practices should become second nature to all career medical officers and should be emphasized especially in the planned training of medical officers being prepared or selected for command and staff positions. Both civilian schools of public health and advanced training courses at the Army Medical Center and the Medical Field Service School should be used to implement such training, and the efficiency reports of medical officers should reflect greater emphasis upon their performance in this particular function.

Plans should be made to enlist the cooperation of selected appropriate national organizations for the sharing of civilian health officers with the military force in times of emergency. In this connection, there must be recognition and acceptance of the fact that future nuclear warfare will fade the line of demarcation between military and civilian health practice.

CHAPTER II

Health Education¹

Granville W. Larimore, M.D., and Lucille Dee Rubin, B.A.

In any war, the duty of preventing the loss of manpower that results from illness and infection is of great importance. During World War II, however, this task reached major proportions. Other losses of manpower were caused by the exposure of our troops to a host of new diseases for which there were no known specific immunizing procedures, as well as to the age-old hazards of malaria and venereal disease.

In the face of these problems, and with the realization that in some theaters of war more men were being invalidated by diseases than by enemy weapons, the need for new techniques to be added to the established armamentarium of preventive medicine became apparent. From this background, the concept of continuing education in health and in disease prevention for the military forces developed.

A consideration of the role of preventive medicine in World War II leaves little doubt of its important influence upon the war effort. But this relationship was far from unilateral. Perhaps in respect to no other discipline involved in the broad field of preventive medicine were the effects of the war as profound as upon health education, for health education may be said to have come of age during World War II. Health education as carried on during World War II can be defined as that process which aimed first at imparting information about health and second at influencing the individual to act upon that information for the protection of his health. To accomplish the first aim, effective teaching aids had to be developed to present essential health information in a simple and attractive form. To achieve the second, a continuing effort to persuade, to motivate, and to induce the individual to utilize the information imparted was required.

Prominent among the factors that contributed to the development of health education during World War II was the very nature of the armed services, which consisted of a large proportion of citizen rather than professional soldiers. Education was the most effective means of influencing these citizens to protect their health. It soon became apparent that the old Army concept of commands and orders must be supplemented by new methods of impressing upon the soldier the need for individual protective measures to maintain his own health and consequently the strength of the armed

¹ The authors wish to acknowledge the contributions of Lt. Col. Thomas H. Sternberg, MC, and Maj. Ernest B. Howard, MC, whose material on venereal disease education was incorporated into this chapter. Acknowledgment is also due Lt. Col. Oliver R. McCoy, MC, whose material on health education for the control of tropical diseases was of assistance in preparing this chapter.

forces. Another factor in the development of Army health education was the growing realization of the value of "propaganda." The success of the German program of indoctrination made it evident that the soldier of the "Light Brigade," who was not expected to "reason why," had been replaced by one who would be most effective if given the explanation for his orders.

During World War I, the term "health education" was not in general use, nor was the concept of education as an effective means of influencing behavior with respect to health generally accepted. Indeed, the history of the Army's experience during the First World War barely refers to the use of health education techniques.

As late as the onset of World War II, it was considered proper for health rules to be imposed from above, and even for personal hygiene rules to be enforced as a command function. One of the typical examples of this attitude was in the field of venereal disease prevention, a problem whose solution was sought solely through regulating the behavior of troops by authority. Venereal disease "education" was covered under Army Regulations No. 40-235,² dated 11 October 1939, in which the commanding officers of each basic unit and detachment were directed to "arrange and personally supervise suitable instruction in sex hygiene and the prevention and control of venereal disease for all enlisted men" under their command.

The instruction was to be given at least twice a year, and was to consist of three basic parts; namely, a discussion by a medical officer on "the nature and gravity of venereal diseases, their effect on mental and physical fitness, the importance of early discovery and treatment, and the means of avoiding them"; a talk by the unit or detachment commander on "the broader social aspects of the problem" and the "harmful influence of such diseases on military efficiency through the absence of men undergoing treatment"; and a discussion by the chaplain of the "moral aspects" of the problem. In 1940, TF (Training Film) No. 8-154, "Sex Hygiene," and a pamphlet, "Sex Hygiene and Venereal Disease," were prepared for use in the training program. However, like the prescribed lectures, the two training aids tended to be didactic and moralizing in tone. In practice, the instruction was generally given before prefurlough lineups and, judging from the results, some of the instruction missed its mark.

To a certain extent, the Army's concentration on enforcing regulations rather than persuading through health education reflected its nature as a military organization. However, at the time of World War II, health education still had to become a generally accepted member of the family of preventive medicine practices.

The growth of health education as a recognized specialty within the preventive medicine field may be regarded as a reflection of our form of government and social structure. Its development was greatly influenced

² Army Regulations No. 40-235, 11 Oct. 1939.

by extending public health beyond the confines of environmental sanitation to encompass many aspects of personal health. Until that extension took place, public health's powers for law enforcement sufficed largely to meet the need for affecting public behavior.

Thereafter, as the concept of public health was expanded, it became necessary to influence individual habits and attitudes toward health. Health education arose first to inform and to interpret to the public its health problems and how public health agencies were meeting them, and second to influence the individual's behavior regarding his own health. The concept of public health education as an undertaking involving all peoples of all ages arose, together with the new field of adult education, during the second and third decades of the century.

HEALTH EDUCATION AT THE BEGINNING OF WORLD WAR II

Except for the film and pamphlet on sex hygiene mentioned previously, and possible brief references in training manuals, practically no health education material on preventable diseases was issued on the national level before the national emergency was declared. However, as the Army rapidly grew during 1941, health education posters and other graphic materials were produced locally at the expanding posts, camps, and stations which faced the need for imparting in a brief time the considerable amount of information men needed to protect their health in a global war.

In the main, health education during this period was carried on largely by lectures, and the medical officers at the various posts were responsible for health training in addition to their other duties. It became apparent, with the tremendous expansion of the Army after Pearl Harbor, that it would not be feasible to use critically needed medical officers for teaching disease prevention under an individualized or even a group teacher-pupil arrangement. Furthermore, because of this rapid growth and the planning of long-term operations, it was clear that the large number of men being processed through basic training would require continued education in disease prevention if the lessons learned in basic training were to be retained. Plans were therefore begun for the preparation of various teaching aids, such as films, posters, pamphlets, and other materials (fig. 7). In March 1942, a Health Education Subdivision was established in the Preventive Medicine Division of the Surgeon General's Office. Experience in World War I, and in military history extending back many years, had shown that venereal disease was a major cause of time loss among military personnel. Experience had also demonstrated that a venereal disease control program which depended upon command and regulation was likely to fall short of success. These two factors influenced the decision to utilize health education as a major venereal disease control measure.

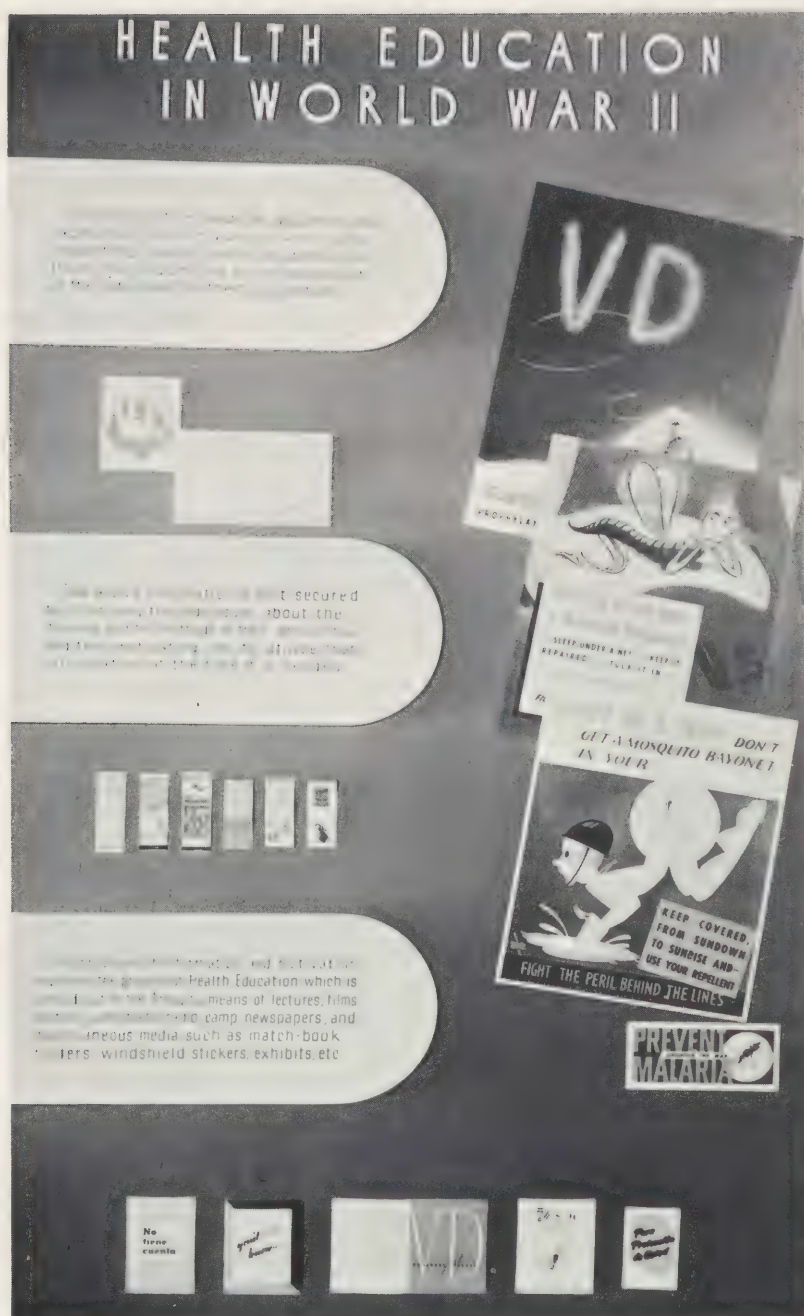


FIGURE 7.—A panel of The Surgeon General's exhibit at the 1946 meeting of the American Medical Association. The illustration pictures a number of the devices utilized during the war to educate servicemen in preventive medicine practices.

EDUCATION FOR THE CONTROL OF VENEREAL DISEASE

The program of venereal disease education developed in World War II far surpassed, both in quantity and quality, any previous program of its type in the Army's history. Indeed, it was probably the most concentrated educational effort ever directed toward a single health problem, either in military or civilian history. Through the media of pamphlets, posters, films, lectures, filmstrips, displays, local poster programs, newspaper articles, personal and group conferences and discussions, and radio programs, military personnel were thoroughly indoctrinated in the fundamental principles of sex hygiene; the nature of the venereal diseases, as well as their diagnosis, treatment, spread, and prevention; and the reasons why they should be avoided. Participating in the development of this program were the Venereal Disease Education Section of the Venereal Disease Control Division, and later, after its formation in January 1945, the Health Education Unit of the Preventive Medicine Service, Surgeon General's Office; the Training Division, Surgeon General's Office; the Training Division, Army Service Forces; G-1 of the War Department General Staff; the Signal Corps; the Adjutant General's Office; the Information and Education Division, Army Service Forces; and many private agencies, particularly the American Social Hygiene Association.³

At the onset of World War II, the principal provisions for venereal disease education were contained in Army Regulations No. 40-235. This regulation gave specific directions for instruction of officers, enlisted men, and recruits, as follows:⁴

In all troop schools * * * for student officers and flying cadets, a course of instruction in sex hygiene will be given, commencing with the school year 1939-40. In such courses there will be stressed the duties and responsibilities of unit commanders in the prevention and control of venereal disease among the members of the unit, and the best methods of accomplishing this prevention and control.

At least twice each calendar year and at intervals of approximately 6 months, the commanding officer of each basic unit and detachment will arrange and personally supervise suitable instruction in sex hygiene and the prevention and control of venereal disease for all enlisted men of his command. * * * A medical officer designated by the post commander will discuss the nature and gravity of venereal diseases, their effect on mental and physical fitness, the importance of early discovery and treatment, and the means of avoiding them. The unit or detachment commander will present the broader social aspects of the problem and will call attention to the harmful influence of such diseases on military efficiency through the absence of men undergoing treatment. A chaplain will discuss the moral aspects.

³ For a comprehensive chapter on the Army's experience in the prevention and control of venereal diseases from the beginning of the mobilization in 1940 to the termination of World War II and during the immediate postwar period, see: Sternberg, Thomas H., et al.: *Venereal Diseases. In Medical Department, United States Army. Preventive Medicine in World War II. Volume V. Communicable Diseases Transmitted Through Contact or By Unknown Means.* Washington: U.S. Government Printing Office, 1960, pp. 139-331.

⁴ See footnote 2, p. 48.

To augment this program of instruction, Training Film 8-154, "Sex Hygiene," and a pamphlet, "Sex Hygiene and Venereal Disease," were prepared and distributed in 1940.

When it became evident in 1941 that this educational material was not being utilized to the fullest possible extent,⁵ it was recommended that the attention of commanding officers be called to the film and pamphlet. Accordingly, a letter was published noting the deficiency and directing that the film be shown wherever facilities permitted and that steps be taken to insure that every recruit receive a copy of the pamphlet upon enlistment.⁶

By May 1942, an adequate, overall education program was not yet in effect. It was observed:⁷

It is generally agreed by those interested in the matter that education in the prevention of venereal disease in the Army is generally not in a satisfactory state. The required lectures have generally been considered a burdensome imposition both on the soldier and the officer, and the latter too often feels himself incompetent to do the job.

In view of this situation, it was recommended that new pamphlet material, films, minute movie shorts with talks by nationally known speakers, posters, charts, exhibits, and the use of educational material prepared by other agencies, such as the American Social Hygiene Association and the U.S. Public Health Service, be developed. No immediate expansion of the program occurred as a result of this memorandum, but plans began for a more vigorous program.

Meanwhile, to supplement the Army training film on venereal disease, a film, "Know for Sure," produced primarily for civilian audiences by the U.S. Public Health Service, was distributed through the corps area U.S. Public Health Service liaison officers.⁸

The slow progress of the education program at the War Department level in 1942 contrasted sharply with the program in the field. Many posts were developing posters and other educational materials for local use and had made arrangements through State health departments and the American Social Hygiene Association for showing venereal disease films other than the official Army film (fig. 8). To provide for wider utilization of interesting ideas, the Surgeon General's Office sent a letter to each corps area surgeon requesting that samples of educational material be submitted for distribution to other commands (fig. 9). It was observed that "Reports have been coming to this office of many interesting and unique educational efforts in the field of venereal disease control * * *. It is believed that

⁵ Memorandum, The Surgeon General, for The Adjutant General, 29 July 1941, subject: Education in Sex Hygiene and Venereal Diseases.

⁶ Letter, War Department, Adjutant General's Office, 9 Aug. 1941, subject: Education in Sex Hygiene and the Venereal Diseases.

⁷ Memorandum, Capt. J. H. Gordon, MC, for Lt. Col. T. B. Turner, MC, 9 May 1942, subject: Education in Sex Hygiene.

⁸ Letter, Surgeon General's Office, to Surgeons, Corps Areas, 11 July 1942, subject: Venereal Disease Educational Film.



FIGURE 8.—A variety of educational material on venereal disease was prepared in the field to supplement that prepared by the Surgeon General's Office. "The Facts of Life," one of the better examples of material produced by field units, was the work of the Surgeon's Office, Third Air Force Headquarters, Tampa, Fla.

much of this material may be of practical value to other commands.”⁹ For several months thereafter, material submitted by the different stations was informally submitted each month to the corps area venereal disease control officers who were thereby enabled to utilize material developed in other commands.

The preparation of poster material locally through poster competitions and by camp venereal disease control officers and their assistants was an important phase of the poster program. However, it was not without its problems, since in some instances it resulted in offensive productions. Because of complaints received by the War Department, it was necessary in May 1943 to warn commanding officers against allowing the use of obscene posters.¹⁰

By the fall of 1942, the venereal disease education program of the Surgeon General's Office began to take shape under the direction of Maj. (later Lt. Col.) Gaylord W. Anderson, MC. The general principles upon which the educational material were to be based were outlined as follows:¹¹ The vocabulary and sentence structure must be simple and nontechnical; poster material must be directed to the age group, language, and emotional and intellectual levels of the soldiers; the whole program should be modeled after the most successful techniques of commercial advertising. It was noted that—

education of a soldier group in the field of venereal disease control presents one of the most difficult problems of health education * * *. The problem * * * is very different from that of any school, college, or industrial group, each of which represents a single segment of society. The problem more nearly resembles that of a national advertising campaign of a product used by all sections of society alike.

The pamphlet “It Doesn't Pay,” prepared by the U.S. Public Health Service, was distributed widely in the Army by State health departments and directly from the U.S. Public Health Service. Its popularity was such that provisions were made for its distribution at all induction stations and at ports of embarkation.¹² Because certain groups objected to some of the material in this pamphlet, it was never distributed throughout the Army.

On 18 September 1942, The Surgeon General recommended the preparation of a brief pamphlet, “Don't Get Off to a Bad Start,” for distribution at induction stations, and a revision of the pamphlet “Sex Hygiene and Venereal Disease” for distribution at reception centers.¹³ This recommen-

⁹ Letter, Lt. Col. Thomas B. Turner, MC, Surgeon General's Office, to the surgeon of each service command, 31 July 1942, subject: Venereal Disease Educational Material.

¹⁰ Letter, War Department, The Adjutant General's Office, to The Commanding Generals, AGF: AAF: ASF: Eastern, Western, Central and Southern Defense Commands; Domestic Service Commands; and Military District of Washington; and to The Commanding Officers, all Posts, Camps, and Stations including exempted stations, 31 May 1943, subject: Venereal Campaign Posters.

¹¹ Memorandum, Maj. G. W. Anderson, MC, for Lt. Col. T. B. Turner, MC, 25 Aug. 1942, subject: Tentative Program of Venereal Disease Education for the Army.

¹² Circular No. 99, Office of the Chief of Transportation, 26 Dec. 1942.

¹³ Letter, Surgeon General's Office, to Training Division, Services of Supply, 18 Sept. 1942, subject: Venereal Disease Bulletin.



FIGURE 9.—In addition to venereal disease, posters and other educational material produced in the field dealt with such phases of health education as malaria and sanitation.

dation was approved on 4 October 1942 by the Training Division, Services of Supply,¹⁴ and the revised pamphlet, "Sex Hygiene and Venereal Disease," was submitted to the Adjutant General's Office for printing. When this pamphlet appeared, the artwork and general appearance were so bad as to evoke the following statement from the Chief, Venereal Disease Education Section, Surgeon General's Office, in a memorandum to the director of the branch.¹⁵

It is with a mixture of indignation and shame that I submit to you herewith the printed copy of the new Army pamphlet "Sex Hygiene and Venereal Disease" * * *. Whatever advantage it may possess is completely vitiated by the outrageous printing accorded it by the Adjutant General's Office. At one time or another I have examined hundreds of pamphlets in the field of health education and can recall none as unattractive in appearance as this * * *.

I am informed by the Adjutant General's Office that one million copies have been printed so we will probably have to suffer with this for six months to a year. The total effect is such that we may, I believe, write it off as a complete loss and plan our program as if no pamphlets whatsoever were available.

The pamphlet "Off to a Good Start" was completed and submitted to The Adjutant General for printing and for distribution to induction stations on 25 November 1942 (fig. 10). Announcement of the availability of this pamphlet was made on 5 February 1943.¹⁶ Particular attention was given the high incidence of venereal disease among inductees following furlough, and the hope was expressed that the pamphlet would improve this situation.

To provide information regarding venereal diseases to troops embarking for overseas theaters, another pamphlet, "Venereal Disease Overseas," was prepared and distributed at all ports of embarkation.¹⁷ Special emphasis was placed on the prevalence of venereal diseases in most overseas areas, the lack of adequate civilian programs, and the dangers of "regulated" prostitution (fig. 11).

On 15 September 1942, Army Regulations No. 40-210, "The Prevention and Control of Communicable Diseases of Man," was published, rescinding Army Regulations No. 40-235, and with it, the section pertaining to venereal disease education. In this new directive, only vague instructions for the conduct of the venereal disease education program were in-

¹⁴ Item 8, p. 5 of 1st Indorsement to basic letter, Training Division, SOS, to The Surgeon General, 4 Oct. 1942.

¹⁵ Memorandum, Maj. G. W. Anderson, MC, for Lt. Col. T. B. Turner, MC, 19 Oct. 1942, subject: Revised Army Pamphlet, "Sex Hygiene and Venereal Disease."

¹⁶ (1) Memorandum, Surgeon General's Office, for Training Division, Services of Supply, 25 Nov. 1942, subject: Printing of Pamphlet, "Off to a Good Start." (2) Letter, Surgeon General's Office, to Commanding Generals, Service Commands, attention: Surgeons, 5 Feb. 1943, subject: Distribution of Venereal Disease Pamphlet at Induction Stations.

¹⁷ (1) Memorandum, Lt. Col. T. B. Turner, MC, for Col. J. S. Simmons, MC, 19 Nov. 1942, subject: Pamphlet for Staging Areas. (2) Letter, Surgeon General's Office, to The Commanding General, Headquarters, Army Service Forces, attention: Training Division, 22 Mar. 1943, subject: Distribution of Venereal Disease Pamphlet.

cluded, and confusion and lack of uniformity resulted. War Department Training Circular No. 28, "Sex Hygiene and Venereal Diseases," which established a definite program, was therefore prepared and published on 3 March 1943. Under the provisions of this circular, military personnel received the following general program of venereal disease instruction:

Induction stations: The pamphlets "Off to a Good Start" and "It Doesn't Pay" were distributed, and posters were displayed.

Reception centers: The pamphlet "Sex Hygiene and Venereal Disease" was distributed. Brief talks by the commanding officer (or his representative), the chaplain, and a medical officer, were given. Training Film 8-154, "Sex Hygiene," was shown.

Replacement training centers: Two lectures, one on venereal diseases and the other on venereal disease prophylaxis, were given by the medical officer. Training Film 8-154 was shown.

Officer candidate schools: A lecture on measures for the control of venereal diseases was given, with emphasis placed on responsibility of unit commanders for instituting and supporting such measures.

Unit commanders receiving troops who had not passed through replacement training centers made suitable arrangements for instruction comparable to that which would have been received at such centers. As an aid to instructors and lecturers, three filmstrips, 8-57, 8-58, and 8-59, with accompanying notes, were prepared and distributed as a supplement to the circular. In 1944, this circular was republished with minor changes.¹⁸

Posters, as a medium of venereal disease education, had been considered an essential part of the program, but because of the differences of opinion and the necessity for clearance among the many War Department divisions concerned with their preparation, no poster was distributed by the War Department until late in 1942. The difficulties encountered in attempting to produce a poster were described by Major Anderson in December 1942.¹⁹

As matters now stand I deal with the Training Division of SOS which deals with War Information Office which deals with a New York group which then deals with the artist. All preliminary sketches have had to come back down the line and all suggested changes go back up the line.

These complicated lines of communication were so cumbersome that it was recommended that local posts be encouraged to produce their own posters.

Despite repeated frustration and the interminable process of "clearance," some progress was made in December 1942. Arrangements were made with the Office of War Information for a professional artist to prepare four venereal disease education posters, the first one of which was

¹⁸ War Department Training Circular No. 22, 1 Apr. 1944.

¹⁹ Memorandum, Maj. G. W. Anderson, MC, for Lt. Col. T. B. Turner, MC, 5 Dec. 1942, subject: Progress on the Venereal Disease Posters.

SEX HYGIENE AND VENEREAL DISEASE

WAR DEPARTMENT



OFF TO A GOOD START

FIGURE 10.—Pamphlets produced in the early days of the health education program. The didactic tone of the writing and the poor quality of production may be contrasted with pamphlets produced later in the war. (See figs. 15, 19, 20, and 23.)



FIGURE 11.—The pamphlet “Venereal Disease Overseas,” prepared for troops going to overseas theaters of operations, stressed the increased danger of venereal disease in foreign countries.

ready for distribution on 19 December 1942.²⁰ This splendid poster, well executed and effectively drawn, carried a brief, clear message. It was a favorite in the field and set the high tone for those that followed. Although this first poster was "ready for distribution on 19 December 1942," it did not reach the field until late in February 1943. Unfortunately, a distribution factor of 1 poster per 750 men was established, a proportion which proved to be inadequate and later had to be increased to 1 per 200 men. In addition to these Army-produced posters, four posters prepared by the American Social Hygiene Association were purchased and distributed in January 1943,²¹ and arrangements were made for the distribution of several posters produced by Wyeth, Inc., pharmaceutical manufacturers, directly to the field.

By 30 January 1943, the educational poster program was summarized as follows:²²

War Department production: "Fight Syphilis and Gonorrhea" was scheduled to come from the U.S. Government Printing Office the first week of February; "Easy to Get" was transmitted to The Adjutant General's Office for printing; "For Their Sakes" was transmitted to the printing office; "Syphilis and Gonorrhea—Axis Partners," a comic-strip poster, was to be prepared; "Them Days is Gone Forever," a comic strip, was being prepared; and four more comic strips, then untitled, were being prepared (fig. 12).

Army purchase: 5,000 of each of four posters were purchased from the American Social Hygiene Association.

Wyeth, Inc.: Arrangements were completed for this pharmaceutical company to supply a poster every 6 weeks, the first three to be available on 6 February 1943.

Reynolds Foundation: The U.S. Public Health Service was preparing a series of posters in cooperation with the Reynolds Foundation.

In the preparation of venereal disease education material, two points were repeatedly stressed: continence and prophylaxis. The philosophy underlying these two conflicting ideas was expressed in February 1943 in a letter to the director of Public Health Education in New Orleans, La.:²³

The Army's education program is built around two main points, (1) Continence is the surest and most desirable means of avoiding venereal disease and (2) Prophylaxis gives considerable protection to the man who will not heed the advice to remain continent. In providing and urging the use of prophylaxis the Army is not condoning or encouraging promiscuity but rather it is facing realistically the fact that many men will be promiscuous in spite of all the counseling as to the desirability of continence and to the risk of infection.

²⁰ Memorandum, Surgeon General's Office, for Training Division, Services of Supply, 19 Dec. 1942, subject: Distribution of Venereal Disease Posters.

²¹ Memorandum, Surgeon General's Office, for Training Division, Services of Supply, 31 Dec. 1942, subject: Use of Certain Venereal Disease Posters.

²² Memorandum, Maj. G. W. Anderson, MC, for Lt. Col. T. B. Turner, 30 Jan. 1943, subject: Present Status of Venereal Disease Posters.

²³ Letter, Maj. G. W. Anderson, MC, to Mr. Jess W. Hair, Director, Public Health Education, New Orleans, La., 6 Feb. 1943.

At the end of March 1943, three Army posters had been distributed. Wyeth, Inc., and the American Social Hygiene Association had supplied several posters; the pamphlets "Sex Hygiene and Venereal Disease," "Off to a Good Start," "Venereal Disease Overseas," and "It Doesn't Pay" were being circulated among certain stations. The U.S. Public Health Service film "Know for Sure" and the U.S. Army film "Sex Hygiene and Venereal Disease" were available, and Film Strips 8-57, 8-58, and 8-59 supplemented Training Circular No. 28, 3 March 1943, which, based on Army Regulations No. 40-210, 15 September 1942, was the basic directive of the venereal disease education program.²⁴

The problems of producing satisfactory venereal disease education materials grew in part out of the rigid Army regulations governing the design and production of printed materials. These problems were also experienced by the education units in other divisions of the Preventive Medicine Service. Under these regulations, control of production, including design and format, was given to The Adjutant General.

The problem was made even more difficult by the role of the U.S. Government Printing Office in publications production. The Government Printing Office indicated repeatedly, as evidenced by the quality of materials produced in the early days of the war, its growing interest in quantity production, rather than educational effectiveness of the materials. The difficulties presented by this and other aspects of venereal disease education were succinctly described by Major Anderson to his successor, Capt. Granville W. Larimore, MC, who replaced Major Anderson as chief of the Venereal Disease Education Section when the latter was placed in charge of the newly established Medical Intelligence Division of the Preventive Medicine Service.

The quality production of materials was accorded top priority and was met by various stratagems whose purpose was to avoid the Adjutant General's Office-Government Printing Office system. One example of these methods was a cooperative arrangement worked out with the Venereal Disease Education Institution, Raleigh, N.C., to produce, under contract, materials specifically designed to meet the Army's educational needs.

The institute, a nonprofit organization, was developed and supported by a grant from the Zachary Smith Reynolds Foundation of Winston Salem, N.C., a philanthropy of the Reynolds Tobacco Company family.

As an outcome of these arrangements, a series of monthly posters was developed for use during 1944 and 1945. All of these posters were designed by skilled artists who could meet the Army's needs for high-quality effective materials, and they were produced on a quantity basis by civilian printers. The arrangements with the institute called for the design, production,

²⁴ Memorandum, Maj. G. W. Anderson, MC, for Lt. Col. T. B. Turner, MC, 29 Mar. 1943, subject: Educational Measures Now in Operation.



FIGURE 12.—Some examples of posters used for venereal disease education. As with all educational material in this field, they stressed two points, continence and prophylaxis.

shipment, and handling of these posters directly to Army installations and commands. The subjects for the posters, the copy on the posters, and the general theme and plan for the artwork were supplied first by the Venereal Disease Education Branch of the Venereal Disease Control Division and

later, after its establishment, by the Health Education Unit of the Surgeon General's Office.

In addition to the poster series, a number of pamphlets were also prepared and released under this system. Among these was the pamphlet "So You've Got a Furlough," which was developed to meet the need for specific educational materials directed toward the soldier going on furlough (fig. 13). The need for such educational materials became apparent when a study of venereal disease rates indicated a high degree of exposure and resultant infections among troops on furlough. This pamphlet was extensively distributed throughout the Army. The layout, design, artwork, effectiveness of presentation, and general quality of this publication and others produced in like manner ("For Women Overseas," and so forth), were far superior to those pamphlets produced by the Adjutant General's Office-Government Printing Office system.

The need for well-written, well-designed, and attractively executed health education materials was pointed up by the experience with the first pamphlets produced under the Adjutant General's Office-Government Printing Office arrangement. The earlier materials were of such poor quality that commanding officers were reluctant to give them to the men, and experience at installations such as induction centers and ports of embarkation, where individual distribution of the materials was made, showed that the men gave them no more than a quick glance and threw them away.

The reluctance to use the poor-quality materials was reflected in the piling up of tremendous supplies in the various Army supply depots. In an effort to defeat this situation, the chief of the Health Education Unit wrote the following letter to venereal disease control officers in each of the various service commands.²⁵

The AGO has informed me that on the basis of the present monthly usage figures they have stocked in their Depots a 28,050 years supply of the pamphlet "Sex Hygiene and Venereal Disease." (The War should last so long.)

While I realize that the pamphlet leaves something to be desired as ideal venereal disease educational material when viewed by our present standards, I do hate to see all of the pamphlets destroyed which is what the AGO will do unless monthly usage figures are increased. Particularly am I reluctant for such destruction in view of the paper shortage and difficulties in producing new materials.

Paragraph 3a(2)(b) of Training Circular 22, 1 April 1944, directs that the pamphlet be distributed to troops at all reception stations which if complied with throughout the Army would give monthly usage figures far in excess of those now being accorded the publication.

In addition the pamphlet can be used as general venereal disease educational material at any of your stations since the distribution to troops going through reception stations has been very spotty and a major fraction of troops in the Army have never seen the pamphlet at all. Hence, I would appreciate it if you would see to it that the pamphlet is distributed at all of your reception stations according to regulations and also, if possible, have all of your stations requisition from the AGO as many of the

²⁵ Letter, Capt. Granville W. Larimore, MC, to Venereal Disease Control Officers, all service commands, 21 June 1945.



FIGURE 13.—Information about venereal disease control was inserted along with other information of value to the serviceman in this well-written and designed pamphlet.

pamphlets as they think they can use during the coming six months so that we can get the pamphlet moving out of the AGO Depots. If you would like to have a supply of the pamphlet sufficient to send a sample copy to each of your stations, I will be glad to forward them to you.

I am writing a similar letter to the other Service Command venereal disease control officers.

In working with the Venereal Disease Education Institute on the preparation of pamphlets, the original writing was done by the chief of the Education Section and his staff. Conferences were then held with the

institute representatives. Each step of the production was closely followed by the unit to insure that the finished product would meet the Army's needs. The material was produced at cost with a flat fee set for the entire project. The printed materials were then procured as supply items, under the same system obtaining for medical and surgical supply items, by the Supply Division, Surgeon General's Office.

This method of producing printed matter was begun by the Health Education Section of the Venereal Disease Control Division and continued when a separate Health Education Unit was set up. Later in the war, however, due in considerable measure, it is believed, to the influence of the Information and Education Division, the quality of material produced under U.S. Government Printing Office auspices improved greatly, and it became possible to return in part to this method of production.

In exploring other methods of producing effective health education materials, the chief of the Education Branch of the Venereal Disease Control Division, and later the chief of the Health Education Unit, surveyed all War Department facilities to see what available means might be utilized in the health education field. This search proved most fruitful in that it revealed a willingness to cooperate on the part of the Information and Education Division of the Army, which had a large staff of excellent writers, designers, and artists. An association with this group which began in 1944 resulted in the production and distribution of a number of excellent health education materials. Among these was the booklet "You Don't Think," which not only was accorded a most favorable reception by Army medical officers, line officers, and troops but also was proved acceptable to chaplains.

The use of matchbook covers for venereal disease education was suggested in a letter to the War Department, Purchasing Office, from the Match Corporation of America, Chicago, Ill., on 29 September 1943,²⁶ and was favorably considered, particularly in view of the enthusiastic reception accorded such matches in a trial at one post. Lt. Col. J. H. King, Jr., MC, of the station hospital at Selfridge Field, Mich., submitted a book of matches on 2 August 1943, which he said was designed at the hospital, was produced by the Match Corporation of America, and was purchased by the post exchange.

He described the matchbook as a new aid in venereal disease control and said it might be found in the pockets of most soldiers on the post. He said it was hoped that the matches, given only to soldiers with the purchase of either cigarettes or prophylactic materials, would increase the attendance at prophylactic stations. Local health authorities, he added, had approved the idea and believed it would not be offensive to civilians if the matches were seen.

²⁶ Letter, W. E. Scaman, Match Corporation of America, to War Department, Purchasing Office, 29 Sept. 1943.

In late 1943, the Army Exchange Service approved use of the matches for sale at post exchanges in all Army posts, camps, and stations. The first matches carried the slogan "Use Willpower—Save Manpower," with the area's green-light medical stations listed on the inside cover.

The matches were so well received by servicemen that they were utilized for health education in fields other than venereal disease control. The Tropical Disease Control Division prepared matchbook covers, carrying educational material on the use of individual malaria prevention methods, for distribution to soldiers in tropical overseas theaters. The Sanitation and Hygiene Division also made use of this medium, which was generally considered a most effective method for disseminating health information. Ultimately, topics covered on the folders included dysentery, trenchfoot, drinking-water purification, and lice control, in addition to venereal disease control. Several million copies were distributed in this country and overseas (fig. 14).

A major advance in the organization and administration of the education program was achieved in February 1943, when funds were requested by The Surgeon General and were allocated by Congress for use in the program.²⁷ The sum of \$415,000 was set aside specifically for the purchase of such materials as posters, pamphlets, and films. Numerous circulars providing for the use of the funds were prepared by The Surgeon General but for various reasons were disapproved by higher authority. Finally the problem reached the Bureau of the Budget, where a circular was proposed placing the responsibility for the use of the funds on The Surgeon General and providing for necessary clearance with the Budget Bureau. Concurrences were eventually obtained, and War Department Circular No. 28, 8 March 1944, appeared. This clearly defined the primary responsibility of The Surgeon General for the preparation of venereal disease education material.

The poster program, which had lapsed pending clarification of The Surgeon General's responsibilities in venereal disease education, was resumed in April 1944, when posters were again distributed each month directly from the printer to all posts at a rate of one poster for each 100 men.²⁸ As noted above, arrangements were made between The Surgeon General's Office and the Venereal Disease Education Institute for the production of posters and other venereal disease education materials. During 1944 and 1945, posters appeared each month presenting a wide appeal and a variety of material.

A total of 44 posters and several new or revised pamphlets were produced for the Health Education Unit by the Venereal Disease Education Institute during this period. The ideas, text, and rough layouts were provided by the Health Education Unit in cooperation with other War De-

²⁷ Memorandum, Maj. G. W. Anderson, MC, for Capt. Zirkle, Fiscal Division, 20 Feb. 1943, subject: Statement Regarding the Venereal Disease Educational Program.

²⁸ Letter, Surgeon General's Office, to Commanding Generals, Service Commands, attention: Surgeons, 12 May 1944, subject: Venereal Disease Educational Materials.

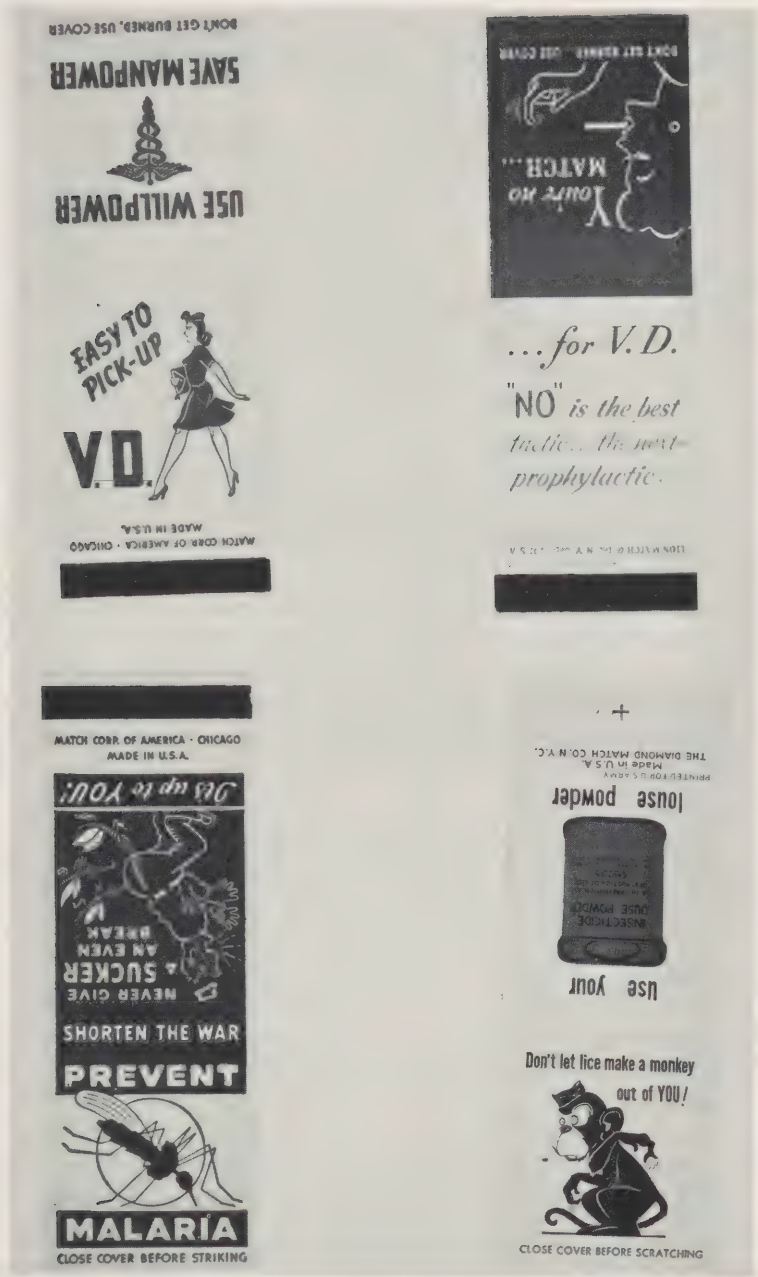


FIGURE 14.—Matchbook covers proved a highly effective means of presenting health education material, since they offered a constant reminder of a disease prevention principle each time a soldier lighted a cigarette.

partment services, with the artwork and production being handled by the institute. As a special service to overseas theaters, a booklet containing a large variety of posters was prepared and sent to each theater with the request that suitable samples be selected for reproduction by the Surgeon General's Office and distribution in the theater.²⁹

In addition, the theaters were informed that any changes requested in available materials would be made and that new material would be furnished upon submission of rough drafts. As a result of the program, 447,229 posters and 3,520,000 pamphlets were shipped to various theaters.

From 1941 to early 1944, only one War Department film on venereal disease, TF 8-154 (later revised as TF 8-1238), was available. This deficiency resulted in the repeated showing of the same film to the same individuals and groups. Often a soldier saw TF 8-154 (or the revision) five or six times. This film, produced in 1940 by the Film Committee of the Motion Picture Academy of Arts and Sciences, was basically one in which an actor playing the role of a medical officer gave an illustrated lecture to the troops on the dangers of venereal disease.

The initial version of the film carried the theme of fear to such a point that it contained a number of technical inaccuracies. As an example, the impression was left that one of the soldier characters in the film who had acquired gonorrhea transmitted his infection through a cigarette butt that he had left on the edge of a pool table where it had been picked up by another soldier.

Opinions of both medical officers and commanding officers regarding the effectiveness of this film can probably be summed up in the remark that it was better than nothing and, with the exception of its inaccuracies, probably did a better job of teaching the strictly medical aspects of venereal disease than could have been done by many medical officers in a lecture. However, virtually everyone questioned its merit as an educational aid. Certainly any value that it had was lessened by its constant repetition and by its abuse on many posts where it was utilized as a means of relieving the medical officer and the commanding officer from responsibility for giving the venereal disease lecture required by Army regulations. Troops saw the film so many times that the actor who portrayed the part of the medical officer was greeted with a vigorous round of applause when he later appeared in several Hollywood productions which played at Army posts.

To take advantage of the obvious value of the motion picture as an education medium, another venereal disease film was authorized in late 1943 and went into production in early 1944 at Paramount Studios in Hollywood, Calif. This film, "Pick Up," TF 8-2060, was distributed in the field in April 1944. In the film, less emphasis was placed on the fear motive

²⁹ Letter, Surgeon General's Office, to Commanding Generals, all theaters, attention: Surgeons, 24 May 1944, subject: Venereal Disease Educational Materials.

and more on other aspects of the venereal disease problem. It was favorably received by both medical officers and commanding officers and, according to reports, was accepted with relief by groups who had been exposed to the excessive use of TF 8-154. "Pick Up" was dramatic in that it incorporated the venereal disease information as part of a narrative, although the role of a medical officer was used as a source for medical and technical information regarding the venereal diseases.

The American soldier in World War II was exposed to the most extensive venereal disease education program in the history of preventive medicine. Approximately thirty million pamphlets and several million posters were distributed. Innumerable lectures, personal conferences, and group discussions were presented. Film audiences were estimated to have reached ten million. An evaluation of the effectiveness of this program was never successfully made. While it was true that in certain commands which conducted particularly active education programs the venereal disease rates were low, there was no thoroughly satisfactory measure of the overall degree to which the education program contributed to venereal disease control in the Army. There seems little doubt that the interest and alertness created by educational means brought about an increased awareness of the venereal disease problem, and greater individual participation in the measures adopted for control.

In a paper presented before the southern branch of the American Public Health Association,³⁰ the author, Captain Larimore, as director of the Education Branch of the Venereal Disease Control Division, and Lt. Col. Thomas H. Sternberg, MC, the director of the division, expressed the opinion that the best criterion for determining the immediate value of education in preventing venereal disease in the Army was probably the extent to which prophylactic facilities and materials were used, because most soldiers were unfamiliar with chemical prophylaxis before entering the service. On the other hand, the rates of venereal disease incidence could not be considered an entirely accurate measure. Although the rates for the first 3 years of the war were not only far lower than those of any past war, and as low as those of any previous 3 years of the Army's history in peace or war, many other venereal disease control procedures shared responsibility for these lowered rates.

In determining the extent of prophylaxis use in the Army, consideration was given both to official station prophylaxis (which was difficult to popularize because of inaccessibility and lack of privacy) and also to the use of individual prophylaxis, both mechanical and chemical. Toward the end of the war, more than fifty million individual prophylactic items were being distributed monthly, an enormous utilization of prophylactic materials that must to a large extent have been a direct reflection of the education program.

³⁰ Larimore, G. W., and Sternberg, T. H.: Does Health Education Prevent Venereal Disease? Army's Experience With 8,000,000 Men. *Am. J. Pub. Health* 35: 799-804, August 1945.

It became evidence in the early days of the venereal disease control education program that there are two related but distinct phases of venereal disease education, and that failure to recognize these separate aspects in the use of education as a venereal disease control measure resulted in ineffectiveness. These phases were:

1. Imparting to the individual adequate technical knowledge about the venereal diseases, how they are spread, and how they may be prevented.
2. Motivating, within the individual, the will to avoid either illicit sexual intercourse or unprotected sexual exposure.

The mere possession of technical knowledge in itself is not sufficient to prevent venereal diseases. It is necessary that the individual be motivated to use such knowledge when it is needed. In the Army, this motivation involves complex and in many instances intangible factors, which are related to such diverse conditions as the religious and educational background of the soldier, the influence of the home and community, the attitude of his commanding officer, the esprit de corps of his unit, his fear of the diseases or of their treatment, his fear of shame or ridicule, and many others, over most of which the Army has little direct control.

In converting the aims of the program into practical education procedures, it was found that certain principles are essential for the successful use of education as a tool of venereal disease control. Chief among these are:

1. Each educational procedure, regardless of type, must be prepared or delivered with a particular purpose in mind. In short, "hit-or-miss" education is wasteful and relatively ineffective. The program must be planned so that each procedure fits into an overall, coordinated whole, each part of which is interrelated to the others.
2. Health education materials should avoid the "pedagogical" approach and should be slanted to the interests, the language, and the attitude of the enlisted man.

The problem of motivation, particularly in view of the varied backgrounds of World War II servicemen, was an extremely complex one. In general, the most effective means of appeal included the following:

1. *Fear*: Fear is the dominant theme of many of the appeals that have been successfully used. Although many of the pedagogical and the medical opinions differ on the value of fear as a motivation, it was found that it operates in the minds of soldiers as one of the most potent reasons for avoiding venereal diseases. Fear is being used in this sense not only as simply a fear of the diseases themselves and the pain associated with them, but also as a fear of the effect on future health and homelife; fear of the effect on sex capacity or the individual's ability to become a father;

fear of punitive measures; and fear of the disease as representing positive proof that religious and moral codes were violated. Fear was found to operate less as a deterrent to promiscuous sex exposure than it did as a motive for inducing the individual to take prophylaxis (fig. 15).

2. *Intelligence*: Appealing to reason for the avoidance of the venereal diseases on logical grounds was of value with the more intelligent portion of the group. When this appeal is augmented with the theme that smart men do not get venereal disease, and that acquiring venereal disease is evidence of a degree of stupidity on the part of the individual, it becomes even more potent.

3. *Pride*: Pride was found to be an effective appeal, not only reflected in the individual's pride in himself, which makes him want to avoid venereal disease, but also pride in his unit, his race, and in the Army itself.

4. *Patriotism*: All of the motivations related to the war itself can be grouped into this category such as those that have their basis in appeals to stay on the job to "keep 'em rolling," or "keep 'em flying," and for each man to shoulder his fair share of the burden and not absent himself because of venereal disease. Another aspect that was effectively used was based on the fact that a man who acquires a preventable infection such as venereal disease is indirectly giving aid or comfort to the enemy by taking up bed space and the time of medical personnel that could be better devoted to caring for the wounded.

5. *Moral approach*: Appeals to avoid venereal disease strictly on moral lines, through the avoidance of illicit sexual intercourse, were found to be of limited value. It is well to recall that venereal disease education as we use the term is not evangelism. It cannot substitute for the home, the church, or the school as a builder of character, nor can it provide a moral background for proper standards of personal conduct. Surveys of troop samples indicate that in a high percentage of instances the initial sex experience occurs before induction into the Army, and there is little to indicate that the health education program was at all successful in converting to continence those individuals who were promiscuous before they entered the service.

The reasons for failures in influencing all soldiers to avoid venereal disease were analyzed, and the following factors appear among the most important:

1. The sex urge itself which tends to cancel out much of the effects of the education efforts.

2. Counterpropaganda against the practice of continence that has been termed "education for venereal disease." This group comprises the sexually stimulating motion picture, the sexy comic strips, the pinup girls, and the mass use of sex as a selling agent in advertising. All of these elements tend to glamorize and romanticize sex and its ever-present byproduct, promiscuous sexual intercourse. Unfortunately, this propaganda for sex



FIGURE 15.—In motivating the serviceman, appeals to fear, intelligence, pride, patriotism, and moral standards were used. These posters exemplify how these motives were used to induce servicemen to guard against venereal disease.

exerts the greatest influence on the younger, more easily impressed age groups.

3. The effect of what is loosely termed "war psychology." It is the same mass reaction that brought about an increase in juvenile delinquency

and a flood of the so-called "Victory Girls." Basically, of course, this prevalent trend is to a great extent a current variant of the old "eat, drink, and be merry" proverb of long standing, accentuated through a wartime release of inhibitions. Translated into terms of the Army problem, we observe men either throwing aside what they have been taught in a burst of so-called last-fling activity or giving vent to a flood of pent-up emotions upon returning from months of arduous and often dangerous duties.

4. The displacement of normal associations with family and friends, with a resultant disruption of customary relationships, which has operated as an effect of the war.

5. The newer methods of treatment which have already begun to lessen the concern of troops over the venereal diseases and their seriousness.

6. Alcohol, with its minimizing effect on inhibitions, which has been a considerable factor in dulling the value of venereal disease education, particularly at a time when the individual needs most to apply what he has learned.

7. Morale or esprit de corps of the man's unit which is a prominent factor influencing the incidence of venereal disease. A man, dissatisfied at the moment with conditions in his Army service, is prone to disregard what he has been taught about venereal disease, and many believe that the venereal disease rate represents a fair indication of the state of morale and discipline of a unit.

EXPANSION OF THE HEALTH EDUCATION PROGRAM

The broadening aspect of the war into one of global character required an expansion of health education activities to cover the diseases and conditions that would be encountered in a war fought in virtually all climates and terrain. Thus, health education branches were provided in the Sanitation and Hygiene and Tropical Disease Control Divisions of the Preventive Medicine Service. These health education organizations carried on separate activities until late 1944, when a Health Education Unit was established in the Preventive Medicine Service.

Health Education in Sanitation and Hygiene

Although sanitation and hygiene have long been a matter of concern in the Army, a number of unusual problems were faced in World War II, largely because much of the fighting took place in areas where sanitation was still at a relatively primitive stage.

In a 1941 report of Preventive Medicine Service activities, Lt. Col. (later Brig. Gen.) Stanhope Bayne-Jones, MC, noted that mobilization, with the assembling of large bodies of untrained troops, gives rise to many

problems in sanitation which must be solved by training and by the development of new methods adapted to military operations.³¹

Throughout the existence of the Medical Department, the sanitation of the Army has been one of its chief functions. As the causes of disease became better known, the importance of sanitation in preventing disease was increasingly recognized.

When the Sanitation and Hygiene Division of the Preventive Medicine Service was established, in January 1944, one of its three branches was Education. The other two were Sanitary Procedures and Sanitary Reports and Policies. Among the duties of the branch were promoting better training in sanitation in the Army through the development of filmstrips in conjunction with the Training Division, Surgeon General's Office, and reviewing articles proposed for publication. At the time of the establishment of this organization on 1 January 1944, there was no one to take charge of the Education Branch, and so the director of the division acted in this capacity.

On 23 March 1944, Capt. Vincent I. Hack, PhC, was brought in as chief of the Education Branch, a position he held until 2 February 1945, when he became assistant to the chief of the newly formed Health Education Unit.

Before World War II, instruction of troops in matters of personal hygiene and other aspects of this subject were covered or prescribed by Army Regulations No. 40-205, 15 December 1924. This regulation made commanding officers of all grades responsible for the maintenance of a satisfactory level of personal hygiene among their troops and for the enforcement of sanitary regulations within their own organizations. The Medical Department was assigned the duty of investigating conditions of personal hygiene and sanitation and of making recommendations about them to the responsible commanding officer.

Instruction for enlisted men in the basic principles of hygiene and sanitation was usually conducted by their company officers or by noncommissioned officers, assisted when necessary by medical officers.

Army Regulations No. 40-204, on which these measures were based, was revised and republished on 31 December 1942. However, in general, the provisions covering personal hygiene for troops remained unchanged. The policies set forth in the original directives, AR 40-205 and its subsequent revision in 1942, were implemented both during the basic training period of the soldier and later during his service years by a continuing program of training and education. Each soldier, at the time of his basic training, was issued Field Manual 21-100, "The Soldier's Handbook," dated 11 December 1940, along with subsequent revisions and reprintings.

³¹ Memorandum, Lt. Col. S. Bayne-Jones, MC, for Chief, Finance and Supply Service, 2 May 1942, transmitting a report of the activities of the Preventive Medicine Service for the previous year [1941] for The Surgeon General's use in hearings before the Subcommittee of the Committee on Appropriations, House of Representatives.

This basic field manual contained a section on military sanitation consisting of instructions for individual compliance with AR 40-205 and explanations for the various provisions of the regulation. A 1-hour class in personal hygiene was a part of the basic training for all soldiers. Training Film 8-155, "Personal Hygiene," was incorporated into this class. This film portrayed the proper application of the regulations aimed at the maintenance of personal cleanliness and hygiene. The material in the film contained little that was new to the soldiers, and the main purpose of the class and the film was to influence the soldier toward maintaining a high level of personal hygiene and to show him the relationship of individual health to the health and efficiency of his unit.

The soldier's education in personal hygiene did not end with the 1 hour of basic training classroom instruction, although the extent and effectiveness of further training varied considerably in the units according to the commanding officer's degree of interest and his appreciation of command responsibility for maintaining proper standards of hygiene.

Training directives that included elements of personal hygiene were issued by all command headquarters. When units were preparing to go overseas, or when replacements were processed through staging areas, further instruction in personal hygiene pertaining to the area of assignment was given. Visual aids supplemented directives, and pamphlets which described the environmental conditions to be expected and the diseases prevalent in the overseas theater were distributed.

For troops destined for the European Theater of Operations particular emphasis was placed on louse control for preventing typhus, and care of the feet for preventing trenchfoot. Troops going to the Southwest Pacific or China-Burma-India theaters were specifically trained in preventive measures against malaria, scrub typhus, and schistosomiasis, and were warned of the dangers of using unapproved food and water.

In the China-Burma-India Theater, greater reliance upon individual personal hygiene measures was necessary than in other theaters since an extensive program of environmental sanitation was considered impractical except in fixed installations. Directives and orientation lectures warned soldiers to protect the skin from prolonged exposure to direct rays of the sun; told them not to work or exercise strenuously in closed spaces; to drink only boiled or chlorinated water; and explained which native foods they should or should not eat. Educational literature given to troops before train movements outlined specific directions to follow when they were forced to eat in native restaurants, and noted that the hot foods were safe but that raw fruits or vegetables should be avoided unless adequately treated.

Field experience indicated that information acquired during the basic training program was quickly lost, and procedures based on that information were no longer carried out unless there was a continuing program of

periodic education of troops, especially on those measures of hygiene and sanitation which were important for the particular area in which the troops were operating. For example, although correct methods of personal hygiene, including proper waste disposal and careful attention to food and water, were covered in basic training, those lessons had to be supplemented sometime later for troops destined for service in theaters where these aspects of personal hygiene were a particular problem.

In addition to the need for continuing education, there were problems which arose in the various theaters which were either not covered at all or not adequately covered in basic training. One of these was the problem of trenchfoot which rose to a high incidence in Italy during December 1943. It became apparent that the solution to this problem lay first in teaching the proper measures for its control and then in motivating the men to utilize them so they could avoid this severely incapacitating condition. War Department Circular 312, "Trenchfoot," prepared and published 22 July 1944 by the Sanitation and Hygiene Division in cooperation with the Training Division, made prevention of trenchfoot a command responsibility. Since individual foot care is of primary importance in prevention of this disease, training aids in the form of brief pamphlets, radio skits, posters, and matchbook covers, to assist in reminding individual soldiers of the importance of foot care were developed for theater use (fig. 16).

A report from the North African Theater of Operations in February 1944 indicated that the shoepac, when properly worn, was effective in preventing trenchfoot. However, there was still the problem of instructing unit commanders in the use of the footgear and the need for seeing that it was properly worn. The Sanitation and Hygiene Division, in collaboration with the Surgical Division, Surgeon General's Office, began preparation of a War Department circular recommending measures for preventing and treating this disease.

Despite the effectiveness of the shoepac, however, it was generally agreed that none of the existing types of footgear could prevent the disease unless certain precautions, such as frequent changing of wet socks, were taken by the individual soldier. It was believed that efforts would have to continue to teach each soldier to care for his feet as well as to assist him as much as possible by supplying sufficient socks.

During this period, the Training Division had been developing a film on the subject, and by January 1945 posters on prevention of the condition had been developed. During January, the European Theater of Operations requested that 6,000 of these posters be forwarded to that theater.

When the Health Education Unit was formed in the Preventive Medicine Service in January 1945, the education activities of the Sanitation Division were transferred to it. The medical administrative office carrying on these functions in the Sanitation Division was transferred to become assistant to the chief of the new unit.



FIGURE 16.—One of the pamphlets prepared in the field to help educate soldiers about the need for individual foot care to avoid trenchfoot, “Pete and his Feet,” was produced in Italy.

Health Education for the Control of Tropical Disease

Although mass control measures were vital to the success of the Army’s program of prevention and control of tropical diseases, the importance of obtaining the individual soldier’s cooperation made education a major part of this program. This was true particularly in malaria prevention, which was the most important problem faced by the Army in tropical regions.

YES, HE HAD IT...

TRENCH FOOT

Just what IS Trench Foot?

It's worse than chilblains.
It's not frostbite.
It's something like both...

IT'S A CRIPPLING INJURY TO THE BLOOD VESSELS
AND NERVE AND MUSCLE TISSUES OF THE FEET
... RESULTING FROM EXPOSURE

It can lead to

Bad Blisters
Gangrene
Amputation

It's Old Man Winter's Worst Weapon

IT'S NO JOKE!

It's a danger as long as the weather is cold and wet,
and that means **ALL WINTER.**

IT'S CAUSED BY:



LACK OF CIRCULATION

We aren't going to talk about
CURE. It's long... It's painful...
It's the business of the medics.

BUT... we can talk about

YOUR JOB

... Prevention

FOR COLD AND WET

- 1 Keep shoes as waterproof as possible. Use dubbin daily. Melt dubbin and pour into seams of shoes between sole and upper.
- 2 Wear overshoes, if you have them.
- 3 Change to a dry pair of socks as often as possible.
- 4 If you have no dry socks, take off wet ones and wring them out. They'll be 80% efficient that way.
- 5 Carry extra socks inside shirt. In inside pockets or in helmet liner. Body heat will dry them.
- 6 Never sleep with shoes on, especially wet shoes, when you can possibly avoid it.
- 7 Remove shoes at least once a day. Twice a day is better.
- 8 Do your best to keep body and hands warm and dry. Good body circulation helps feet keep warm.
- 9 If your foxhole is muddy or holds water, bail it out. Put down logs, branches, or stones to stand on.
- 10 Lace shoes and leggings loosely.
- 11 Never put on so many socks that you can't move your toes.

FOR LACK OF MOTION

1 MASSAGE

Bare your feet and RUB BRISKLY for a full 5 minutes. This isn't easy alone, but two men can team up to massage each other's feet.

ONE GOOD SHOT OF CIRCULATION A DAY IS YOUR MINIMUM INSURANCE AGAINST TRENCH FOOT

2 MOVEMENT

Move your feet whenever possible. Wiggle your toes inside your shoes. Elevate your feet for short periods. Push feet against side of foxhole. Bounce up and down on your toes.

3 EXERCISE

A FOOT FLEX



Position: Sitting, legs crossed. Push the foot down, pull it up, turning it inward. Keep the toes turned. Repeat 10-20 times.

B TOE FLEX



Position: Sitting, legs crossed. Push the foot down, pull it up, turning it inward. Keep the toes turned. Repeat 10-20 times.

C TOE GRASP



Position: Sitting, legs crossed. Push the foot down, pull it up, turning it inward. Keep the toes turned. Repeat 10-20 times.

You've got to think of yourself —
FEET FIRST

FIGURE 16.—Continued.

There is little doubt that individual control measures would have been far less successful without large-scale operations to destroy mosquitoes and mosquito breeding places. However, individual control measures—the use of bed nets, chemical repellents, and antimosquito sprays; the wearing of protective clothing and avoidance of unnecessary exposure; and the regular ingestion of suppressive drugs—were also necessary.

These measures became increasingly important under field conditions as troops moved forward from fixed installations and as combat activities interfered with or prevented antimosquito control measures at base in-

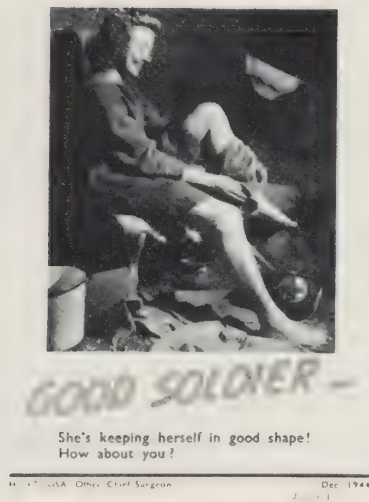


FIGURE 16.—Continued.

stallations. If malaria is to be prevented in forward areas, when there is the greatest need for all men to be in fighting condition, the individual soldier must be made fully aware of the necessity for protecting himself against malaria. He must be taught and continually reminded of preventive measures and be motivated to use these measures for protecting his health.

When the Tropical Disease Control Section was separated from the Epidemiology Branch and became a division in January 1944, one of the four branches established was Education.³² The others were Control Policies, Field Survey, and Malaria Control. The functions of the Education Branch were to initiate informative circulars, posters, pamphlets, and other material and to arrange programs of special training for the specialized personnel needed in tropical disease control.

Unfortunately, however, the concept of continuing health education as a necessary supplement to the didactic instruction given during basic training was not fully developed until late in the war. The early emphasis was on lectures, and little was done to make the training effective from an educational standpoint. While some attempt was made to motivate the soldier to care for his own health, malaria discipline was a command responsibility, and the unit commander was held responsible for the control of malaria within his unit and unit area.

The lack of a rounded program of health education, with all that term implies, was noted by Lt. Col. Oliver R. McCoy, MC, director of the Tropical Disease Control Division, who wrote: ³³

³² Office Order No. 4, Office of The Surgeon General, U.S. Army, 1 Jan. 1944.

³³ McCoy, Oliver R.: War Department Provisions for Malaria Control. In Medical Department, United States Army. Preventive Medicine in World War II. Volume VI. Communicable Diseases: Malaria. Washington: U.S. Government Printing Office, 1963, p. 55.

The importance of health education as a program separate from didactic training in disease prevention was not appreciated early enough nor its value widely recognized. Experience indicated that the propaganda phase of preventive medicine warranted more thorough and systematic exploitation.

In September 1943, new regulations requiring a minimum of 4 hours of special training in malaria control for everyone in the Army were put in effect with the publication of WD Circular 223, "Malaria Control in the Army." These provisions for special training were kept in effect by a subsequent WD circular published in 1945, when a revision of the training circular was also issued. In general, the regulations provided that the training was to be completed as soon as possible, and new inductees and future inductees were to get their instruction before leaving the continental United States. Details of the instruction, including an outline of the material to be presented during the course, were published in WD Training Circular 108, "Malaria Control and Malaria Discipline," 21 September 1943.

In his 1944 annual report, Colonel McCoy credited the training and special provisions for malaria control prescribed by the circular with contributing to the "marked improvement in overseas malaria rates which has occurred during the past year." These had been developed by the Education Branch under Capt. (later Maj.) Choice B. Matthews, MC. Subsequently a graphic training aid, 8-4, to supplement the training circular, was produced with consultative advice from the division.

As the need for education beyond the basic training period became more apparent, attempts were made to utilize every opportunity for health education about tropical disease preventive measures, particularly those which the individual soldier had to carry out himself. Among the media employed for this purpose were posters, pamphlets, cartoon motion-picture films, recordings for broadcasts, and signs and printed warnings on matchbook covers and ration containers.

In the summer of 1943, a booklet entitled "This is Ann" was published for distribution to troops headed for tropical theaters.³⁴ Written and illustrated by a professional writer and a cartoonist of national reputation then on the staff of The Surgeon General, Capt. (later Maj.) Munro Leaf, MAC, the booklet presented information about malaria and the *Anopheles* mosquito in an attractive and interesting manner. The format used had proved particularly effective as a vehicle for educational material, especially for children in civilian life. "This is Ann" represented the first departure from the traditional Army "information circular" type of educational material in the tropical disease control field (fig. 17).

³⁴ War Department pamphlet "This is Ann." Washington: U.S. Government Printing Office, 1943.

Material from the booklet was also utilized as poster material on the back of the weekly *newsmaps* prepared by the Information and Education Division of the Army. These maps, in themselves a unique vehicle for educational material, were distributed weekly throughout the Army. One side of the maps, which were approximately 30 by 40 inches, carried a map showing battlelines and troop positions or graphic illustrations of troops or other military subjects together with a brief summary of the news highlights of the week. The reverse side was used for educational and informational purposes. The news side was displayed for 1 week, and then the map was turned over on the bulletin board and the educational material was displayed for a week. The weekly *newsmap* was used extensively as a health education vehicle for tropical disease control information earlier in the war and later, after the formation of the Health Education Unit, for all types of health education material.

In addition, a great many other media were produced for education of troops. These included:

Motion-picture films.—Consultation services were given to the Army Air Forces in the production of the film “Malaria Discipline,” TF (Training Film) 1-3343. This picture stressed command responsibility for malaria control and the need for individual discipline in preventive measures. It supplemented TF 8-953, which emphasized the basic measures for malaria control.

An Australian film, “The Silent Battle,” Miscellaneous Film No. 1046, was adapted for continuing health education in malaria control.

Two animated cartoons were produced by the Morale Services Division, Army Service Forces, as part of the “Private Snafu” series. These films, which were included in the Army-Navy Screen Magazine and were given wide showing, used humorous characters and situations to make the educational material interesting. This technique, utilized in many of the posters, matchbook covers, and booklets developed during the war, proved one of the most effective tools in providing continuing education for men with the diversified backgrounds and education levels that were found in the Army.

The cartoons “Private Snafu vs. Malaria Mike,” released in Army-Navy Screen Magazine No. 23 in March 1944, and later issued as Miscellaneous Film 1035, and “Private Snafu in Target for Tonight,” released in Army-Navy Screen Magazine No. 38 in October 1944, pictured the difficulties experienced by Private Snafu when he neglected to observe the proper antimalarial precautions. Each had a running time of about 4 minutes. A third cartoon film in the series, “It’s Murder, She Says,” was released in Army-Navy Screen Magazine No. 52 in May 1945.

The division, through Major Matthews, its assistant director and chief of its Disease Analysis Branch, gave professional advice and assist-

THIS is Ann



she's dying to meet you.



Use a little horse sense.

You can keep from getting MALARIA if you've got the stuff to stop a mosquito from biting you. USE it. And use your brain.

What to do if Ann gets you.

The Medical Corps can help you recover if you get plugged, so report yourself in if you get a headache, chills, and fever.

DON'T FORGET THIS.

You can't get MALARIA unless Ann plugs you, but if she does, she can make

you just as dead as a shell can, or lay you out flat for a long, long stretch.

Never give Ann a break.

She'll bat you down and it won't be funny.



FIGURE 17.—“This is Ann” is an example of one of the highly professional publications prepared by the Surgeon General's Office. The booklet represented the first departure from the Army “information circular” type of educational material in the tropical disease control field.

ance in photographing the development of the insecticidal uses of DDT (chlorophenothane) at the Orlando, Fla., laboratory of the U.S. Department of Agriculture. This material, prepared for incorporation in a general film on DDT, was produced under the technical direction of the Health Education Unit.

Major Matthews also acted as technical adviser in the editing and addition of a soundtrack to a film on malaria control activities in Corsica, Italy. The picture, also produced under the general direction of the Health Education Unit, illustrated the practical side of malaria control, and was developed for use in training malaria control personnel.

A request was initiated to obtain the cooperation of the Signal Corps in preparing 20 cartoon strips to be added at the beginning of feature motion-picture films. Experience has shown that these cartoon strips, which emphasized individual measures for malaria prevention, were highly effective reminders in promoting malaria discipline. The project was carried on under the technical supervision of Maj. Frank A. Mantz, MC, Chief, Malaria Control Branch, in cooperation with the Training Division, Surgeon General's Office.

Posters and stickers.—The series of 15 posters stressing individual malaria prevention measures was completed early in 1944. From 500 to 40,000 copies of each poster were distributed to the theaters in which malaria was a problem (fig. 18).

Sixty thousand stickers with the slogan "Malaria mosquitoes breed in road ruts. Do your part to stop it. Stay on authorized roads" were distributed overseas for use on vehicle windshields. Another 100,000 with the slogan "Shorten the War—Prevent Malaria" were also distributed. Reprinting of both stickers was necessary because of the large number of requests for them (fig. 19).

Recordings.—With the cooperation of the Morale Services Division,³⁵ a recording stressing the hazards of malaria and of individual methods of prevention was prepared. The record, entitled "Know Your Enemy—Malaria," was approximately 20 minutes in length and was suitable for broadcast over local radio networks and loudspeaker systems. Copies were distributed to malarious theaters overseas, to service commands, and to ports of embarkation for issue to transports bound for tropical areas.

Miscellaneous.—Instructions about malaria prevention measures were printed on the wrapping of individual ration boxes.³⁶ This policy served to keep the soldier constantly aware of the need for staying on guard against the malaria-carrying mosquito.

Much the same purpose was served by the matchbook covers, which

³⁵ Memorandum, Chief, Preventive Medicine Service, SGO, to Director, Morale Services Division, ASF, 30 Mar. 1944, subject: Recording entitled "Know Your Enemy—Malaria."

³⁶ Memorandum, The Surgeon General, for The Quartermaster General, 5 Nov. 1943, subject: Label for K-Ration Carton.



FIGURE 18.—Posters were prepared to stress the danger of malaria and the need for individual precautionary measures to prevent the disease.



FIGURE 19.—Stickers urging malaria prevention methods were prepared for use on vehicle windshields.

carried health education messages, succinctly and humorously written.³⁷ A design for a matchbook cover, stressing the need for constant awareness of the threat of malaria, was approved by Army Exchange Service as acceptable for sale in Army post exchanges.

HEALTH EDUCATION UNIT

As the war lengthened, it became apparent that a program of continuing education in the health field was essential. This program needed to be closely related to the didactic instruction received by troops during the training periods at reception and training centers. In addition, it was desirable to combine and coordinate the various health education activities so that the continuing education of the soldier with respect to his health could be conducted as a whole rather than a piecemeal program. To meet these needs, the Health Education Unit was established in the Preventive Medicine Service.

The first formal step in the development of this unit was taken on 10 November 1944, when Brig. Gen. James S. Simmons submitted to the director of the Control Division a memorandum proposing the establishment of a Health Education Unit in the Preventive Medicine Service. The functions of the unit would be: "To prepare plans and materials for carrying out the program of the Preventive Medicine Service for continuing the health education of military personnel; and to coordinate this program with the other military agencies concerned."³⁸

The proposal was amplified in a subsequent memorandum 10 days later in which General Simmons noted that, except for minor changes,

³⁷ Memorandum, The Surgeon General, for Army Exchange Service, ASF, 1 Nov. 1944, subject: Proposed Design for Match Cover.

³⁸ Memorandum, Brig. Gen. James S. Simmons, Chief, Preventive Medicine Service, for Director, Control Division, 10 Nov. 1944, subject: Proposed Health Education Unit in Preventive Medicine Service.

the organization of the Preventive Medicine Service had been in effect since the first of the year (1944).³⁹ During this period, he said, a study had been conducted of the functional arrangements of the service, and recommendations had been made for streamlining the organization. One proposal was to condense into a single unit, to be designated the Health Education Unit, the Education Branches of the Sanitation and Hygiene, Tropical Disease Control, and Venereal Disease Control Divisions.

In his memorandum, General Simmons said it had been found desirable to establish this unit to formulate and execute a forceful coordinated program for the preparation of health education materials which would continuously implement the preventive medicine education of military personnel beyond the preliminary training periods.

The unit was to be attached for administrative purposes to the office of the chief of service and was to report directly to the assistant chief of service. The latter officer was to be responsible for coordinating the activities of the unit with the various divisions in the Preventive Medicine Service. The initial military personnel for the unit would be drawn from those branches then engaged in health education work.

On 6 January 1945, General Simmons was granted tentative authorization to establish the proposed Health Education Unit. The authorization was given in a memorandum, which noted that the final organization of the Surgeon General's Office was still in progress and that it was not considered desirable to approve any final organization charts until this was completed.

General Simmons selected Captain Larimore, chief of the Education Branch of the Venereal Disease Control Division, to head the unit. Captain Hack was chosen to be assistant chief. Captain Hack had been chief of the Education Branch of the Sanitation and Hygiene Division since 23 March 1944.

Funds to support the unit were made available by the transfer of education funds from the Sanitation and Hygiene, the Tropical Disease Control, and the Venereal Disease Control Divisions.

The need for organizing a new unit to serve the entire Preventive Medicine Division had been made particularly urgent by the shift in emphasis of the war to the Pacific, with consequent multiplication of preventive medicine problems. It was necessary to expand and intensify the health education program for the large numbers of troops who would soon come into contact with diseases which were new to them. Avoidance of these diseases was essential to the conservation of military manpower and the prosecution of the war.

A health education program had to be directed against such diseases as schistosomiasis, scrub typhus fever, amebic dysentery, and malaria. All of these diseases and others with which our troops were to come into contact were, for the most part, illnesses against which there was no vaccine

³⁹ Memorandum, Brig. Gen. James S. Simmons, for the Director, Control Division, 20 Nov. 1944, subject: Proposed Reorganization of Preventive Medicine Service.

or other specific immunization procedure. Prevention depended to a very large degree upon the individual soldier's knowledge and application of proper protective measures. The aim of the Health Education Unit was to give him this knowledge and to motivate him so that he would use it when it was needed. Some indication of the means by which it was to accomplish these aims may be seen in the duty statement for the chief and assistant to the chief of the unit.⁴⁰

The Chief, Health Education Unit * * *. Serves in an advisory capacity as consultant on all matters of health education to the various Division Directors and the Chief, Preventive Medicine Service. Initiates, directs and carries out health education projects involving the use of moving pictures, radio, posters, pamphlets and miscellaneous media which are intended to continue the education of the soldier in measures necessary for the protection of his health after he has completed his basic training. Provides source material, prepares picture plans, assists in scenario production and supervises the technical direction of all health educational films in preventive medicine subjects. Exercises direct professional supervision over the production of posters, pamphlets, radio scripts and other health education materials.

Besides assisting in developing plans and policies regarding the health education program, the assistant to the chief, under the latter's supervision—

Is directly responsible for the procurement and cataloguing of slides, charts, graphs, posters, drawings and other illustrative material in preventive medicine subjects for use in teaching and in preparation of technical publications.

Approximately 5,000 photographs, charts, and drawings, and 500 slides were catalogued, indexed, and collected. In addition, the assistant to the chief—

Reviews stock film footage to determine its value for use in the health education program. Prepares charts, graphs and designs for use in teaching and for inclusion in publications on preventive medicine subjects. Do rough artwork and preliminary sketches for graphic health education materials.

The unit was also given a number of responsibilities in the professional medical field, as follows:

1. Supervising the design, production, and procurement of all slides, charts, and other teaching materials used by members of the Preventive Medicine Service in teaching medical officers and other professional groups.

2. Collecting, captioning, indexing, and maintaining a complete file of photographs and drawings of sanitary devices and other preventive medicine subjects which were made available to members of the Preventive Medicine Service as teaching material and as illustrations for training publications.

3. Responsibility for professional motion pictures in the preventive medicine field on the Surgeon General's Office Professional Film Board as a representative of the Preventive Medicine Service. This board directed

⁴⁰ Memorandum, Health Education Unit, Preventive Medicine Service, undated, subject: Duties of the Chief and Duties of the Assistant to the Chief.

the motion-picture projects produced by the Museum and Medical Arts Service units. In addition, the unit planned, arranged for technical direction of, and handled production details on medical professional films in the preventive medicine field produced for the Surgeon General's Office by the Signal Corps.

Among the subjects covered by these films were yaws, schistosomiasis, quarantine procedures, civil public health activities in Germany, nutritional survey procedures, Japanese B encephalitis, the role of the medical laboratory, and sandfly fever (pappataci fever).

4. Service as secretary to the Program Committee, Preventive Medicine Service. This committee reviewed all publications emanating from the Preventive Medicine Service, particularly the technical medical bulletins in the preventive medicine field. An attempt was made to simplify and to make as effective as possible the presentation of the valuable information contained in these bulletins, since they often represented the major contact medical officers in overseas theaters had with advances in medical knowledge. These bulletins played an important role in the maintenance of technical skills in field units.

The work of the unit was coordinated with the Training Division of the Surgeon General's Office and the Museum and Medical Arts Service. Between the chief of the Health Education Unit and the chief of the Training Division and his staff, there was close coordination of the development and utilization of materials and the plans and policies for continuing education of the soldier. In addition, the chief of the unit served as liaison officer of the Surgeon General's Office with the Army Newspaper Service of the Information and Education Division, Army Service Forces. The materials of this latter division, including the weekly *newsmap* (referred to in more detail in the section on tropical disease control, pp. 77-85), were utilized to the fullest in presenting health education materials. Among other groups with whom the unit worked closely were the United States of America Typhus Commission; Supply Service, Surgeon General's Office; the Office of The Adjutant General; the Medical Division, Army Ground Forces; the Signal Corps Photographic Center, Astoria, Long Island, N.Y.; and the Special Troop Problems Branch of the Office of the Chief of Staff.

Accomplishments of the Unit

Films.—In the first half-year of the unit's existence, the entire program of health education films for the Preventive Medicine Service was studied, and recommendations were made for revisions and additional films needed to fill gaps in coverage. Within 1 year, twice as many preventive medicine teaching films were either in production or being planned as were available before the unit's establishment. Preliminary work also was

carried on in revising and bringing up to date all existing films in the preventive medicine field.

Films completed from 6 January to 30 June 1945, on preventive medicine subjects, were: Film Bulletin No. 180, "Trench Foot"; Film Bulletin No. 195, "DDT, Weapon Against Disease"; and Film Bulletin No. 200, "Malaria Control in Corsica".

Because of the special problems of venereal disease control among Negro troops, a film particularly designed for Negro military personnel and entitled "Easy to Get" was produced in early 1945 and distributed in August of that year. The film was produced at the Signal Corps Photographic Center, as a joint Signal Corps-Surgeon General's Office project. Because of the complex problems involved, an especial effort was made to provide a careful briefing for the script writer, the director, and other personnel concerned with the film. The director of the Health Education Unit, the Surgeon General's Office, visited Fort Huachuca, Ariz.; Fort Benning, Ga.; Tuskegee Army Air Field, Ala.; and a number of other military installations where there were large numbers of Negro troops in order to give the script writer a thorough briefing in the problems involved.

Lt. Col. George McDonald, MC, the Negro medical officer who had developed the successful venereal disease control program at Tuskegee Army Air Field served with the chief of the Health Education Unit as technical director of the picture. Because of the personal interest of the Civilian Aide on Negro Affairs to the Secretary of War, Mr. Truman K. Gibson, Jr., the assistance of many Negro organizations and groups was secured. A number of Negro actors and actresses and leading Negro citizens either gave their services toward the production of the film or worked for nominal salaries. Among these were Joe Louis, then the heavyweight champion of the world; Paul Robeson, the Negro singer; and other prominent persons. Negro troops responded favorably to this film as did medical officers and commanding officers who reported that for the first time a specific training aid directed toward this particular problem had been developed.

Other motion-picture activities included miscellaneous films on scrub typhus fever, schistosomiasis, and sandfly control; a revision of Training Film 8-1288 on louseborne diseases; and a series of 20 short cartoon "trailers" on malaria. All these films were directed toward the health education of the individual soldier. In addition to these and the previously mentioned professional films for training of Medical Department personnel, the unit engaged in a joint project with the Information and Education Division, Army Service Forces, for a film containing material on malaria and on venereal disease to be shown at reception stations to soldiers returning home. In June 1945, the venereal disease rates among recent returnees from overseas were exceedingly high. For this reason, the education program directed toward these men was augmented by providing for the showing of "Pick Up" on all transports; distribution of "So You've

Got a Furlough" at reception stations; distribution of a large exhibit consisting of several panels, each carrying a venereal disease message, to reception stations; increased emphasis on venereal disease by orientation lectures at reception stations; and the inclusion of venereal disease education material in a film for returnees.

Posters.—In coordination with the different divisions of the Preventive Medicine Service, the Health Education Unit planned and instituted poster programs for preventable diseases. Background material was obtained from the divisions concerned with the subject, and comprehensive color layouts were prepared by the civilian consultant to the unit.

In the first 6 months, 13 posters, including three on venereal disease and 10 on general sanitation and hygiene topics, were issued. A poster series on tropical diseases also was undertaken. As originally planned, the series was to include 24 posters—four on scrub typhus, three on schistosomiasis, six on malaria, two on cholera and dysentery, two on plague, two on sandfly fever, two on filariasis, two on dengue, and one on fungus infections of the foot. After V-J Day, however, the entire program was canceled as part of the general War Department publication policy at the time, even though posters on schistosomiasis and scrub typhus were ready to go to press.

After considerable discussion and conferences with the chief of the unit, the War Department Publication Board agreed to reinstate the series, with modifications to meet the current and immediate postwar needs of the Army in the Pacific. The number of malaria posters was to be cut from six to four, and those on cholera and dysentery, plague, sandfly fever, filariasis, and dengue were cut to one each, leaving a total of 17 posters. The designs of the posters were so adapted to postwar conditions as to represent a reservoir of graphic health education material to meet Army needs for the next few years.

Pamphlets.—Among the pamphlets prepared were those on malaria for officers; sanitary improvisations in the field, and venereal disease for women overseas. Others included "You Don't Think," a graphic illustration pamphlet prepared in conjunction with staff members of the War Department Information and Education Division; "So You've Got a Furlough," developed jointly by the Information and Education Division, Army Service Forces, and the Surgeon General's Office, which included material of general interest as well as venereal disease information to soldiers on furlough; and a revised "Venereal Disease Overseas," and "Even Snafu Knows," requested by the China-Burma-India Theater (figs. 20 and 21).

To meet the special needs of Puerto Rican troops for educational material in the field of venereal disease, two short pamphlets entitled "Para Proteccion de Usted" and "No Tiene Cuenta" were developed in conjunction with the Venereal Disease Control Division. Assistance in preparing these materials was obtained from the medical staff of the Pan

American Sanitary Bureau. There were medical personnel on the bureau staff who were familiar with the level of knowledge about venereal disease that could be expected of Puerto Rican troops. The bureau also gave expert advice in the educational approach toward this group (fig. 22).

Radio.—The unit cooperated with the Armed Forces Radio Service in arranging spot announcements and other coverage of health education subjects. The material was recorded and forwarded to overseas radio stations to be played back as transcribed announcements interspersed among regular-broadcast programs. This network of Armed Forces radio stations were widely utilized, particularly in the tropical theaters, for orientation, information, and entertainment of troops located in isolated island bases. Material on preventive measures for schistosomiasis and other tropical diseases was frequently incorporated in the broadcasts of this network.

Newspapers.—Arrangements were made with the News Service of the Information and Education Division, Army Services Forces, to furnish health education material to all camp newspapers as part of the weekly clippingsheet supplied by the division.

One project in which the Health Education Unit participated was the preparation, jointly with the Training Division, Surgeon General's Office, of a graphic portfolio on personal health. The unit obtained the background material for the teaching doctrine and rendered assistance in the preparation of the artwork for the portfolio, which was devoted to personal health with an emphasis on the relationship of good personal hygiene to the prevention of disease and the maintenance of health.

Health Education for the Women's Army Corps

The addition of female personnel to the enlisted ranks of the Army in the form of the WAAC (Women's Army Auxiliary Corps), and later the WAC (Women's Army Corps), posed problems from the health education standpoint just as it did in a number of other fields. Many of the manuals, training aids, and other training material utilized in the basic training of troops were obviously not suitable for use during the basic training period for Women's Army Corps members.

The Women's Army Corps, with the help of its medical staff, headed by Maj. (later Lt. Col.) Margaret D. Craighill, MC, Chief WAC Medical Officer, adapted training material or developed new materials to meet the special needs of this military group.⁴¹ Later, as WAC members became widely distributed on field assignments, the same problems of continuing education in the field of health arose as they had arisen for male personnel. The chief of the Health Education Unit conferred on many occasions with Major Craighill and provided advice and assistance in the development of health education materials to meet special problems. Although the venereal diseases among WAC personnel never approached the major health

⁴¹ Memorandum for Director, Women's Army Corps, 4 Oct. 1943, subject: Health Education for the WAC.



Keep yourself in condition to perform the duties for which you were sent on foreign service. You owe it to *Yourself* and to your country.

Venereal diseases are catching—they are caused by germs. *No One Is Immune.* You may have had intercourse with a prostitute, or pick-up, without getting a venereal disease—but your luck can't hold out forever. You are like the gambler playing

...easy 'pick-ups'!



"NO'S," the best tactic...the next, PROPHYLACTIC!

AVOID INFECTION!

the house. He may win temporarily but the machine is set for the house to win and he cannot beat it. With easy women the odds are also against you. *It Can Happen To You.*

These two added together spell trouble just as the mixing of gasoline and alcohol. The drunken soldier will consort with a woman who ordinarily would be repulsive to him, throwing caution to the winds, forgetting both condom and prophylaxis. The greatest number of men who get *VD* do so while intoxicated, and sincerely regret it later.

Some soldiers will have sexual relations with prostitutes and loose women in spite of the warning of their Medical Officers. It is for these men that the prophylactic stations are established. If you are going to fool around with such women, use a rubber and take prophylaxis. **Do Both—Not Just One or the Other.**

FIGURE 20.—Snafu, the popular cartoon of the private who was always in trouble, was used with great effect to present health education material. He appeared in motion-picture shorts and pamphlets, and on posters and matchbook covers.

problems that they represented among male troops, Major Craighill felt that the subject of venereal disease and sex hygiene, in general, should be covered as part of the total health education program.⁴²

Major Craighill's viewpoint in the matter was substantiated by the experience of field commanders who indicated that correct information on this general subject was often inadequate among women entering the service.

To meet this need, materials especially addressed to women were developed for use in basic training and for continuing education of WAC personnel on field assignments. However, because of unfavorable publicity which the Women's Army Auxiliary Corps received early in its existence, there was reluctance to do anything that might attract attention to this problem. This reluctance was based on an understandable desire to avoid any further adverse publicity. For this reason primarily, recommendations for the production of a motion picture on venereal disease for women, together with other educational materials in this field, were denied by Col. Oveta Culp Hobby, Director, Women's Army Corps. To fill the gap, and because of the need for such health education materials, expressed by commanding officers and by members of the WAC themselves, utilization was made of the film developed for women personnel in the Canadian armed services. Arrangements also were made with the American Social Hygiene Association to develop a film on venereal diseases for women which, while addressed to women in civilian life, would have value for the Women's Army Corps.

The Canadian film proved most valuable and was extensively used at WAC installations throughout the war. The attempted arrangement with the American Social Hygiene Association was less successful. From the beginning, great efforts were made to conceal the fact that the Army had an interest in the project on behalf of the Women's Army Corps. Negotiations with the American Social Hygiene Association were largely of an "off-the-record" nature, and were directed toward having the association approach the Army with an offer to produce a film on venereal diseases for women with a request for the Army's cooperation.⁴³ While the negotiations were concluded successfully, the film itself was not a success, since its content did not meet the specific needs of the Women's Army Corps. Moreover, its educational policy was not of a level which made it an effective teaching tool. Both of these defects were at least partly related to the enforced remote relationship of the unit to the production of the film. This separation

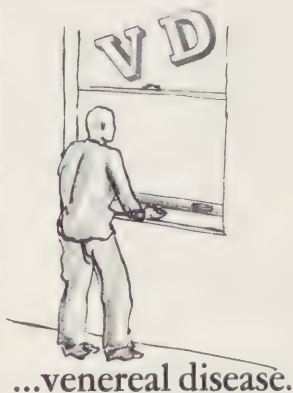
⁴² (1) Memorandums, Capt. Walter M. Smith, for The Surgeon General, thru: Chief, Preventive Medicine Service, 22 May 1944, and 24 May 1944, subject: Health of WAC With Particular Reference to Forts Oglethorpe, Georgia, and Des Moines, Iowa. (2) Health Education Program for WAC, by Maj. Margaret D. Craighill, MC, 4 Oct. 1943.

⁴³ (1) Letter, Walter Clarke, M.D., Executive Director, American Social Hygiene Association, Inc., to Capt. Granville W. Larimore, MC, 24 Sept. 1943. (2) Letter, Walter Clarke, M.D., to Lt. Col. Thomas B. Turner, MC, 24 Sept. 1943. (3) Memorandum, Lt. Col. T. B. Turner, MC, for Director, Women's Army Corps, 2 Oct. 1943, subject: Health Education for the WAC.

WAR DEPARTMENT PAMPHLET NO. 21-15

YOU DON'T THINK...

...IT CAN
EVER
HAPPEN
TO
You



EVEN your
DOCTOR
can't
tell —
*without the
aid of
Laboratory tests —*

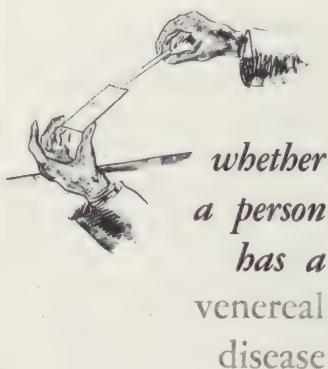


FIGURE 21.—“You Don’t Think,” another attractive and extremely successful pamphlet, was prepared in conjunction with staff members of the War Department Information and Education Division.

prevented the development of the film along lines that would meet Army needs. As a result, the only film utilized in the sex hygiene program of the Women's Army Corps was the one made by the Canadians.

To meet the need for a simple booklet on venereal diseases, negotiations were entered into with the Venereal Disease Education Institute at Raleigh, N.C., to adapt one of its publications for distribution among WAC personnel. The booklet was rewritten and given a new title, "You'd Better Know." The artwork was redesigned with the assistance of the Information and Education Division of the Army to present the material in an attractive and effective format. Despite the innocuous title and the attractive "geometrical" cover design, Colonel Hobby ruled that the pamphlet not be distributed to Wacs without being enclosed in a heavy opaque, blank white cover. This decision met resistance not only from the Medical Department but also from those in the Army concerned with the conservation of a critically short paper supply. Despite these objections, Colonel Hobby maintained her position, and the booklet was distributed with the double cover (fig. 23).

Later in the war, when WAC members were utilized in overseas installations, it was found desirable to provide specific information for women personnel regarding venereal disease in overseas theaters. A booklet, "For Women Overseas," was developed in cooperation with Major Craighill. This booklet, also attractively designed and prepared with the help of the Information and Education Division, was produced for the Army under contract by the Venereal Disease Education Institute. Because of the experience of the double cover on the previous booklet which, it was reported, was usually torn off and discarded by the recipients, this booklet was distributed without the plain wrapper.

Problems Faced by the Unit

Among the problems faced by the Health Education Unit in developing its program was a lack of appreciation of the value of health education as an effective means of reducing time loss caused by disease. This was in part related to what was felt to be a failure by some line officers, at practically all levels of command, to realize the importance of preventive medicine. Another factor, it is believed, was the suspicion and even distrust military men had of using techniques aimed at persuasion and motivation to influence behavior, rather than issuing the flat command. The attempt to develop an education program aimed at preventing schistosomiasis serves to illustrate this difficulty. When the Army moved into the Philippine Islands early in 1945, an intensive health education program was carried on to give troops an understanding of the various diseases to be encountered. Although there was considerable interest in the prevention of schistosomiasis on the part of both medical officers and commanding officers in the area, this interest in the educational aspects of the disease was not shared

No tiene cuenta

Para Protección de Usted

Muchas veces se puede evitar los efectos del contagio valiéndose de ciertas medidas antes y después del coito. El nombre científico de estas medidas es PROFILAXIS, que quiere decir protegerse contra las enfermedades.

En este caso, la profilaxis consiste en usar un protector o condón durante el acto sexual y productos químicos después. El condón protege tanto el hombre como la mujer. Los productos químicos protegen al hombre únicamente. El condón es como un tabique que impide que los microbios pasen de una persona a la otra. Por lo tanto, lo más seguro es servirse del condón primero y hacer uso después de productos químicos como precaución adicional.

No se arriesgue.
Protéjase siempre.
Emplee la profilaxis.

6

Instrucciones de como usarse El Paquete Profilactico "PRO-KIT"

Primero debe orinar.

El Condón Protege Al Hombre y a La Mujer

Todavía no se ha encontrado ninguna manera infalible de evitar la sífilis o la gonorrea cada vez que hay contaminación. Hoy día el condón es el medio más seguro que se conoce para evitar la sífilis y la gonorrea como resultado de relaciones sexuales.

El condón que se llama también preservativo de caucho es una vaina elástica



Protected
Unprotected

Parte protegida
Parte sin proteger

7

FIGURE 22.—Special educational material was prepared to meet the needs of Puerto Rican troops. The medical staff of the Pan American Sanitary Bureau provided information about the educational approach to, and the level of knowledge about, venereal disease, that could be expected of these troops.

at all levels of command. In fact, efforts of the Health Education Unit to develop educational materials about this medical problem were blocked by high-level command in the Army Ground Forces. In explaining their position, the officer in Army Ground Forces headquarters who transmitted the refusal told the chief of the Health Education Unit, he thought all The Surgeon General did was think up diseases with names no one could pronounce and then ask for time to be devoted to education about them in the training schedule for troops. The most important part of training troops, he said, was to teach them how to handle a gun, and time should not be wasted on diseases with such names as schistosomiasis.

It was not until many hundreds of soldiers suffering from schistosomiasis were sent back to this country for hospitalization that the Army Ground Forces reversed its attitude and health education materials on this subject were developed. These included a film, posters, and other printed materials. Newspaper items, roadside signs, and demonstration vans all warned of the dangers of bathing or swimming in fresh-water streams and ponds. The educational program was the chief weapon against this disease, and as troops recognized the severity of the disease and understood its mode of transmission, the incidence decreased.

The difficulties of producing effective materials under the Adjutant General's Office-Government Printing Office channels and the means of circumventing them have already been described in the section, "Education for the control of Venereal Disease," pp. 51-73.

Another continuing problem in this field was the opposition of chaplains to certain aspects of venereal disease education, particularly those which were aimed at prophylaxis. It was the doctrinal viewpoint of the chaplains that all venereal disease education should be directed along moral lines stressing the virtues of continence. Experience of the Medical Department clearly indicated that this type of approach had serious limitations for many soldiers whose sex habits were already established before they entered the service. To prevent venereal disease among these soldiers, the Medical Department strongly believed that, in addition to preaching chastity, simple accurate information must be provided about the protection prophylaxis affords. While all chaplains did not react strongly against the teaching of prophylaxis, there were many who did particularly with respect to mechanical prophylaxis. This problem of assistance in obtaining necessary clearance from the chaplains was met by the Information and Education Division which, toward the end of the war, interceded, with considerable success, on behalf of the Medical Department with the Office of the Chief of Chaplains. A particular example of this is the booklet "You Don't Think," clearance of which was handled by the Information and Education Division staff.

Another problem that caused great delay in producing health education materials, particularly during the early days of the war, was that of

WAR DEPARTMENT PAMPHLET 35-4

*For Women Overseas**you'd better know...*

THIS is a book about two diseases that have caused women more pain and suffering than any other two infections. These diseases are syphilis and gonorrhea. Because women and girls have known too little about them, many women have died from syphilis, or have been left crippled or childless by gonorrhea. Hundreds of thousands of babies have died before birth, or have been born deformed, or blind because their mothers did not know how to protect them from syphilis and gonorrhea. Women owe it to themselves and to their children to learn the facts about these diseases. It is a woman's right and her duty to know

. the truth about

- 1 -

*For Women...*

There is no entirely safe mechanical or chemical prophylaxis that women can use against venereal diseases. Douches are not adequate and may do more harm than good. Chemical agents strong enough to kill the organisms often cause serious and permanent damage to the tissues. The only sure protection is continence.

It's up to You to keep fit!

You are being sent abroad to do an important job. To do it well you must keep in good physical condition. No woman wants to let her country down by becoming a casualty because of a disease caught unnecessarily. No matter where you are or how common or serious the venereal diseases in that country, you do not have to catch them. When you are in the service, your health is a matter of concern to the Army, because you are needed on the job.

If you need advice or help, do not hesitate to consult your medical officer.

FIGURE 23.—The production of educational material to be used in teaching WAC personnel about venereal disease was extremely difficult. On the order of Col. Oveta Culp Hobby, the first pamphlet, "You'd Better Know," could not be distributed without being encased in an opaque, blank white cover.

having material cleared and produced through channels. The difficulties encountered are discussed in the section on venereal disease education, p. 57.⁴⁴ Because of personal idiosyncracies and preferences, it was almost impossible to get agreement on any piece of material, no matter how good. This problem was solved in part when the Division of Preventive Medicine received a direct financial authorization from Congress for educational materials. Clearances were then limited in the main to the chief of the Preventive Medicine Division of the Surgeon General's Office and to the Office of the Chief of Chaplains.

TECHNIQUES OF HEALTH EDUCATION

One major development in the field of health education during the war (and one that has had a major effect on health education since that time) was the adaptation of techniques that had been successfully utilized in advertising but had not been considered necessary or suitable for educational purposes.

These techniques included the use in printed materials of color and design to catch the eye; the use of clever phrases or slogans to catch the ear, and the practice of constant repetition. Soldiers found health education material wherever they looked or listened—on matchbook covers; on their packages of C- and K-rations in the field; at their motion-picture theaters; over their radios; on posters in their barracks, their recreation rooms, and even their latrines; and in illuminated displays set up in areas where troops congregated and were required to wait for long periods. Guidebooks issued before furloughs gave information about travel in the area and listed the location of prophylactic stations. Each of these exposures to health education material acted much as a booster-dose does in immunization and was aimed at keeping at a high level the serviceman's awareness of the health problems he faced during his Army career.

One essential to the successful operation of such a health education program was found to be an understanding of the basic role of each of the types of materials to be utilized. Films, manuals, and lectures were used for carrying on basic instruction, while posters, pamphlets, matchbook folders, radio programs, motion-picture trailers, windshield stickers, and newspaper coverage provided the followup, reminder type of education.

Another essential was to have all material of high quality and attractive, with a liberal amount of color and artwork. The importance of attractiveness as a factor in reader appeal was emphasized by surveys which indicated that a large percentage of servicemen would not wade through a solid page of back type unrelieved in its monotony by art or color. They would not wade through technical language. The use of terminology not

⁴⁴ See footnote 19, p. 57.

easily understood results in the rapid loss of reader interest and failure to transfer the message.

The entire program must be so coordinated that each piece fits as part of a carefully planned design. Haphazard hit-or-miss methods were found to be unsuccessful, as was the campaign "Let's Prevent Malaria Week" type of health education. Experience showed that it was far more effective to utilize a continually repetitive technique than it was to put forth a great effort for a short time followed by a lengthy period of relaxation.

In general, there are two methods of altering the conduct of individuals with respect to matters concerning their health. One of these is health education; the other is health legislation. Health education, the technique of influencing people to achieve better health, ideally combines the informativeness of the teacher with the persuasiveness of the salesman. Health legislation, on the other hand, employs the coercion of laws and regulations backed by penalties for their violation.

One might expect that the Army, an organization more accustomed to rule by legislation than a civilian body, would depend exclusively on health legislation as opposed to health education. Such, however, was not the case, for it was the Army's experience, just as it has been the experience of civilian health agencies, that the diseases which prevent the most difficult control problems are those which require the active participation of the individual for their prevention.

The events of World War II showed that this active participation cannot be obtained in every instance by rules and regulations no matter how inclusive the regulations or how sincere and vigorous the enforcement efforts. The individual must be informed of the necessity for carrying out a particular preventive measure and, further, be so convinced of its need that he carries it out whether or not there is someone at hand to force his compliance.

CHAPTER III

Occupational Health and Industrial Medicine

W. Leigh Cook, Jr., M.D.

THE ARMY'S INDUSTRIAL MEDICAL PROGRAM

The earliest known mention of an occupational disease is probably that of Hippocrates who recorded the effects of lead poisoning on miners in the fourth century B.C. Perhaps the earliest preventive hygiene was observed by Pliny 500 years later when he saw the refiners of minium (mercuric sulfide) wearing bladders as masks to avoid inhaling the dust. Gradual increase in scientific knowledge brought both industry and medicine into closer relationship over the centuries. Paracelsus and Ramazzini bridged the long span into the 20th century when industrial medicine reached its peak in the crisis of World War II. By this time, principles of democracy and of economics had integrated industry, labor, and hygiene, at least in the United States, and raised all three to a national level of mutual concern. Research in this area had developed sufficiently for its emphasis to change from inquiry into causes of occupational disease to the anticipation and correction of hazardous conditions.

The Medical Department of the U.S. Army first became cognizant of the need for control of occupational health hazards in Army industrial plants when, on 10 August 1938, the Chief of Ordnance requested medical care for civilian employees of the Ordnance Department who were engaged in potentially harmful occupations, particularly the handling of TNT (trinitrotoluene).¹ He specifically asked that contract physicians perform periodic physical examinations in six ordnance depots primarily engaged in the production of ammunition and explosives. The Surgeon General replied that at that time there was no provision in the Medical Department for carrying out such a service, but recommended that it be referred to higher authority for decision as it was highly desirable that the matter of medical responsibility be definitely determined.

The Chief of Ordnance forwarded this correspondence to The Adjutant General on 5 October 1938 and contended that because of the occupational hazards and of the legal responsibility of the manufacturer, in this instance the War Department, diagnostic and preventive measures concerning possible industrial or occupational illnesses would appear to be an essential and direct governmental responsibility. He recommended

¹ Letter, Maj. H. C. Minton, Executive Officer, Ordnance Department, for the Chief of Ordnance, Office of the Chief of Ordnance, to The Surgeon General, U.S. Army, 10 Aug. 1938, subject: Periodic Physical Examinations of Ordnance Civilian Employees Engaged in Deleterious Occupations.

either that the Medical Department furnish such service or that steps be taken to have the U.S. Public Health Service or other proper agency provide it. As a result, additional pay was arranged for contract surgeons at the plants in order that periodic physical examinations could be performed on the civilian employees engaged in handling TNT and in other potentially harmful occupations. Heretofore, civilian employees of Government-owned industrial installations had been receiving first aid treatment for illness and injury at dispensaries or first aid stations operated by part-time contract surgeons, nurses, and Medical Department enlisted men.² These small medical installations were provided when and if a technical service of the War Department felt a need for them.

Continued pressure from the Ordnance Department for supervision of the medical problems encountered in its expanding activities during the limited emergency period of 1939 and 1940 caused The Surgeon General to become more aware of the necessity for controlling occupational health hazards in Army-owned industrial establishments. Conferences were held with representatives of the Army and the U.S. Public Health Service, and in October 1940, the latter offered consultation services on industrial hygiene as soon as provision for medical care in the various arsenals would be effected by the Army.³

In November, it was stated that the Army expected to operate medical services at the following industrial installations: Rock Island Arsenal, Rock Island, Ill.; Springfield Armory, Springfield, Mass.; Picatinny Arsenal, Dover, N.J.; Watertown Arsenal, Watertown, Mass.; Watervliet Arsenal, Watervliet, N.Y.; Frankford Arsenal, Philadelphia, Pa.; Erie Ordnance Depot, La Carne, Ohio; and Kelly Field, San Antonio Air Depot, Duncan Field, and Normoyle Quartermaster Depot. The four last-named installations were all located at San Antonio, Tex., and would be under the same medical supervision. The U.S. Public Health Service was asked to send industrial hygiene personnel, as represented by one of its field units, to each of these installations as they became ready for operation. The function of the industrial hygiene unit was to inspect the plants in conjunction with Army medical personnel, to ascertain the hazards, if any, and to indicate what changes might be necessary or procedures advisable for protection of employees.

Acceptance of Medical Responsibility for Arsenal Employees

Meanwhile, in a letter, dated 18 November 1940, from the Chief, Professional Service Division, Surgeon General's Office, to the Assistant Surgeon General of the U.S. Public Health Service, the duty of medical care

² Letter, The Surgeon General, to The Adjutant General, 12 Dec. 1940, subject: Medical Service at Arsenals and Other Military Industrial Plants.

³ Letter, The Assistant Surgeon General, U.S. Public Health Service, to The Surgeon General, U.S. Army, dated 30 Oct. 1940.

of civilian employees at Army arsenals under the Ordnance Department was definitely assumed by the Medical Department of the Army. It was also indicated that The Surgeon General intended to place a medical Reserve officer in charge of each governmental arsenal rather than a civilian contract surgeon.⁴

At the same time, The Surgeon General had realized that the Air Corps, the Quartermaster Corps, and the other technical services must also be included, as they were all expanding and developing and keenly felt the need for qualified industrial hygienists. He stated his opinion that since leading manufacturers had established trained personnel to handle these problems, "The Army should not assume an inferior position in the protection of employees in industrial plants." A further program of plant inspections in cooperation with the U.S. Public Health Service was approved by The Adjutant General on 14 February 1941.

United States Public Health Service Extension of Surveys

To determine the extent to which the contemplated industrial medical program would apply throughout the proposed and materially expanding industrial plants of the War Department, letters were sent to the Chief of the Air Corps and to The Quartermaster General by The Surgeon General requesting information on the number of employees, military and civilian; number of shifts being worked; medical personnel; clinical laboratory facilities available; availability of safety engineers and special safety facilities; and principal work performed by each plant. By March, plans were underway to survey all plants of the Ordnance Department, Quartermaster Corps, and Air Corps with a view to determining the industrial hazards that existed to develop adequate facilities for their control.

National Research Council

During this preliminary activity of the Surgeon General's Office in establishing an industrial medical program for the Army, members of the Preventive Medicine Division had consulted with the Subcommittee on Industrial Health and Medicine of the Committee on Medical Research, Office of Scientific Research and Development. This subcommittee recommended the institution of "an organized health maintenance program under competent medical direction within each of the major departments of the Federal Government." It advised that thorough studies of the situation be made by the Division of Industrial Hygiene, National Institute of Health, U.S. Public Health Service, and suggested that the results of these surveys "would serve as a basis for recommendations on the content of the program,

⁴ Memorandum of Conference, Col. [C. C.] Hillman, Col. [J. S.] Simmons, Dr. Draper, and Dr. Neal, regarding cooperation between the U.S. Public Health Service and the U.S. Army Medical Corps in industrial hygiene work in arsenals, 28 Nov. 1940.

including personnel and facilities as well as functions." The subcommittee also suggested that the program "be operated from a central point" and cautioned against its extension to the care of employees for nonoccupational sickness and injury.⁵

Establishment of Industrial Hygiene Section in Preventive Medicine Division, Surgeon General's Office

As evidence of the increasing need for a medical program for civilian employees of War Department industrial installations accumulated, the necessity for establishing a separate section in the Surgeon General's Office to determine policy and organize an overall program of industrial medicine became clear. The establishment in the Preventive Medicine Division of a section on industrial hygiene was effected on 18 April 1941. The new unit was included in the Subdivision of Epidemiology and Disease Prevention and Industrial Hygiene.⁶ The first officers assigned to it were Capt. (later Col.) Theodore C. Bedwell, Jr., MC, and Capt. (later Lt. Col.) Leon H. Warren, MC.

Problems of Toxic Exposure

Simultaneously, with the growing concern over hazards in the Army's industrial program, there was developing another concern over the toxicity inherent in newly developed items of supply and equipment and in the material used to render items mildew proof for use in the Tropics. The annual report of the Subdivision of Epidemiology and Disease Prevention and Industrial Hygiene for 1940-41 indicates that an increasing number of requests for toxicologic evaluation were received. During the next 2 years, they were referred to that branch of the Surgeon General's Office best suited to solve the particular problem; this was usually one of the branches of the Preventive Medicine Service. A considerable number of these requests were ultimately handled by the Army Industrial Hygiene Laboratory, located at The Johns Hopkins University School of Hygiene and Public Health, Baltimore, Md. However, this system was satisfactory only as long as the number of requests was small but was not adapted to handling large numbers of interrelated problems. Eventually, a Toxicology Branch within the Occupational Health Division was established. This took place on 1 January 1944.

Clarification of The Surgeon General's Responsibility

One of the many difficulties encountered in attempting to establish a functionally efficient industrial medical program stemmed from duplication

⁵ Report, Selby, C. D., to Crabtree, J. A., on meeting of the Subcommittee on Industrial Health and Medicine, Office of Scientific Research and Development [undated].

⁶ Office Order No. 87, Surgeon General's Office, U.S. Army, 18 April 1941.

of effort on the part of several War Department agencies attempting to accomplish this specific objective. Such instances of duplication, occurring throughout the war, emphasized the necessity for proper clearance of projects and directives with all agencies concerned in any one problem. The following incident occurred early in the formative period of the industrial medical program, and the resultant confusion forced The Surgeon General to seek clarification of his responsibilities toward the Army's industrial medical program.

On 18 March 1941, the Secretary of War issued a memorandum to the Chiefs of Bureaus, Arms, and Services on the health and safety of civilian employees engaged in defense activities under the supervision of the War Department. He called attention to the consultative services of the U.S. Public Health Service, recommended that full advantage be taken of them, and assigned the duty of coordinating and handling requests for the services to the Safety Officer, Office of the Chief of Engineers.

In view of this memorandum, which was never officially acted on, The Surgeon General called to the attention of The Adjutant General that he, in cooperation with the U.S. Public Health Service, had caused to be made a number of surveys in Army-operated industrial plants in the United States. He recommended that he be instructed to provide for the first aid treatment of injuries and illnesses on a compensable basis in accordance with the rules of the U.S. Employees' Compensation Commission and to provide such industrial hygiene personnel and laboratories as would be necessary to control and prevent industrial injuries or diseases. These suggestions were approved by The Adjutant General.

To carry out this mission, The Surgeon General, on 17 September 1941, sent a similar memorandum to the Secretary, War Department General Staff, in which he again requested that he be charged with the assignment of establishing an industrial medical program for the Army.

As a result of this correspondence, on 5 January 1942, The Adjutant General issued a directive,⁷ as follows:

1. The Surgeon General will make all necessary provisions for the emergency treatment of military personnel and civilian employees in Army-operated industrial plants and for the supervision of industrial hygiene in such plants.
2. The Army Medical Department will be reimbursed at the rate of \$3.75 per day for each person hospitalized, and 50 cents for each case rendered first aid treatment, by the United States Employees' Compensation Commission.
3. Dispensary space will be furnished by the arm or service in charge of the industrial plants and depots concerned.
4. All existing equipment in dispensaries in Army-operated industrial plants, from whatever funds procured, will be turned over to the Medical Department without reimbursement.

⁷ Letter, The Adjutant General, to The Surgeon General, The Quartermaster General, Chief of the Air Corps, Chief, Chemical Warfare Service, Chief Signal Officer, Chief of Engineers, and Chief of Ordnance, 5 Jan. 1942, subject: Policy on Medical Service to Civilian Employees in Army-Operated Industrial Plants and Depots.

5. Arms and services now employing civilian nurses in arsenals and depots will transfer sufficient funds to The Surgeon General for the continuance of their employment during the fiscal year 1942.

6. The Surgeon General is authorized to establish a central industrial laboratory at the Army Medical School at a cost not to exceed \$3,000.

7. Medical Department personnel will not be used for duty in such Army-operated industrial plants and/or depots when required for duty with troops units and installations in the Army of the United States.

On 16 January, The Surgeon General announced this policy in a directive to all corps area surgeons, outlined the program to be carried out, and summarized its development as follows:

Due to the rapid expansion of Army-operated industrial plants, it became obvious in the spring of 1941 that careful surveys should be made to determine the industrial hazards in these plants. Because Medical Department personnel trained in industrial hygiene were not then available to conduct these surveys, The Surgeon General requested the U.S. Public Health Service to have its Industrial Hygiene Division make studies in certain designated Army-operated plants. The information secured from the reports of these surveys has been utilized in the correction of existing hazards and in planning the future industrial program. The personnel of the Industrial Hygiene Section, Surgeon General's Office, have made inspections of Army plants in cooperation with U.S. Public Health Service officials. Conferences have been held with representatives of the various branches which operate industrial plants and depots in the Army and their cooperation has been secured to carry out effectively the industrial hygiene program. Studies have been made of medical personnel, supply, and equipment requirements for Army industrial plants and recommendations made to the division of the Surgeon General's Office concerned. In addition, the Industrial Hygiene Section has sponsored research investigations of certain industrial hazards on which adequate information is not available. This work had been arranged through the National Research Council.

It is the desire of this office that a well-balanced and coordinated industrial hygiene program be conducted in Army-operated industrial plants * * *.

This marked what might be termed the conclusion of the first period of activities of the War Department in establishing medical service for civilian employees of Army-owned and Army-operated industrial installations.⁸ It followed approximately 2 years of effort on the part of various War Department agencies to promote the establishment of this service which was to play such an important role during the war in the overall productive activity of the huge industrial organization either owned by the War Department or operated under its jurisdiction.

ESTABLISHMENT OF THE INDUSTRIAL MEDICAL PROGRAM

Organization of New Subdivision

Discussions with specialists in industrial medicine led The Surgeon General to request the appointment of Dr. Anthony J. Lanza, Assistant

⁸ A change in Army Regulations No. 170-10, 26 July 1943, and War Department Circular No. 211 (section III), 8 Oct. 1941, placed the medical service at all Army-operated industrial plants and depots under the corps area commander.

Medical Director, Metropolitan Life Insurance Co., in the grade of lieutenant colonel, as chief of a separate occupational hygiene subdivision which was to be formed to replace the earlier section. Doctor Lanza reported for duty in March 1942 and retained his position of director of the Occupational Hygiene Division until he retired from the Army in December 1944. He was joined in September 1942 by Capt. (later Lt. Col.) William L. Cook, Jr., MC, who served as assistant director until he succeeded Colonel Lanza as director. An office order, Surgeon General's Office, on 12 August 1942, changed the name and status of the activity from Occupational and Military Hygiene Subdivision to Occupational Hygiene Branch.

Before taking up his military duties, Doctor Lanza conferred with Col. (later Brig. Gen.) James S. Simmons, MC, Chief, Preventive Medicine Division, and, after a thorough study of the problems presented by the War Department's enlarging industrial activities, submitted on 9 February 1942 a plan for the organization and projected activities of the new subdivision.⁹ By the end of the war, most of the activities mentioned in this memorandum were being carried on through the Occupational Health Division. The plan for the new subdivision was as follows:

1. Industrial Hygiene Section, Preventive Medicine Division: Besides a medical officer in charge and one other officer, two more medical officers should be assigned.
2. Aside from the administrative functions, the medical officers should be used for field inspections. They would act as laboratory field unit officers, when necessary. When a Government-operated plant is to be surveyed by the laboratory field unit, one of these medical officers would participate in the survey, usually with the laboratory technicians, or at about the same time. According to circumstances, either a medical officer or a laboratory technician might be used to make a check inspection, to ascertain if previous recommendations have been carried out and if they are producing desired results. These medical officers would inspect plants to determine whether the procedures detailed in the letter of 16 January 1942 to corps area surgeons, concerning medical examinations and medical attendance, are being properly carried out, and to make such recommendations to correct omissions or poor performance as may be necessary.
3. Reports of surveys, inspections, or other observations will be made in detail to the Industrial Hygiene Section, and then relayed to the proper officials in the Surgeon General's Office and to corps area surgeons, the local commanding officer, and such other officials or executives as may be indicated.
4. It should always be borne in mind that the purpose of surveys and inspections is not only to determine quality of performance and compliance with regulations but also to carry on an educational program with plant medical officers, officials, and personnel. Tact and consideration of all concerned are here highly important.
5. A master file should be set up, in which each plant coming within the jurisdiction of the Industrial Hygiene Section would be indexed with its own folder wherein would be contained a record of every inspection, report, and other item concerning that particular plant.
6. A "tickler" file should be provided for calling up planned visits, surveys, or inspections.

⁹ Memorandum, Dr. A. J. Lanza, Metropolitan Life Insurance Co., New York, N.Y., for Col. J. S. Simmons, MC, Director, Preventive Medicine Division, Surgeon General's Office, 9 Feb. 1942. [Inclosure to letter to Colonel Simmons.]

7. Similar files, as noted in paragraphs 5 and 6, should be maintained at the laboratory, with duplication of items where indicated.

8. Uniform records for physical examinations, reports of occupational disease cases, absentee records, and so forth, should be provided. Records of absenteeism for sickness should be such as to make comparison possible with records from all kinds of industrial plants throughout the country, now being collected and compiled by the statistician of the U.S. Public Health Service.

9. As soon as practical, it should be determined what type of reports are to be made by the Industrial Hygiene Section to the director of the Preventive Medicine Division.

10. What has been stated in the foregoing paragraphs applies also to Government-owned, privately operated plants. It may be advisable to vary procedure but the Industrial Hygiene Section should know, by first hand inspection as far as this is practical, that health conditions affecting employees in these plants are satisfactory, that occupational disease hazards are properly controlled, and that standard records of sickness absenteeism are kept.

11. Records of sickness absenteeism and of occupational disease cases should be forwarded by the medical officer in charge of a plant or by other proper official to the Industrial Hygiene Section, probably at monthly intervals.

12. On the various military reservations are workshops, repair shops, and schools wherein industrial health hazards may exist. As soon as practical, provision should be made to check on this situation and to inaugurate a continuing program of inspection and control.

13. All injuries, requests for information, and requests for educational material concerning industrial health and hygiene from the various subdivisions of the War Department should be referred to and cleared through the Industrial Hygiene Section.

14. The distribution of booklets, leaflets, films, and other material pertaining to industrial health and hygiene to employees of plants coming within the jurisdiction of the Surgeon General's Office should be approved by the Industrial Hygiene Section.

15. Stimulation of health education programs for employers is an important function of the Industrial Hygiene Section.

Immediate problems.—At this time, in addition to long-term planning, a number of problems demanded immediate attention. War Department installations within the Zone of Interior were divided into four classes. Of these, class IV installations comprised those of a predominantly industrial character and were as follows: Quartermaster Corps depots, manufacturing plants, and repair shops; Ordnance Department arsenals and depots; Chemical Warfare Service arsenals; Signal Corps depots and laboratories; Corps of Engineers depots; and ports of embarkation (so designated in August 1943). Because of the increase in personnel of all existing industrial installations and the intended establishment of many new plants, it was necessary that physicians with experience in industrial medicine be immediately commissioned from private life to carry out the War Department's occupational health program. Requirement of a training course in industrial medicine for Regular Army Medical Corps or other officers would have delayed the initiation of an adequate program. Additional problems faced in the new subdivision concerned the design and standardization of dispensary buildings and first aid rooms for newly constructed plants and

the standardization of a supply program which would be adaptable to The Surgeon General's overall medical program.

Service command cooperation.—The surgeons of the service commands were receptive to advice and assistance from the Surgeon General's Office in establishing the industrial medical program. The surgeons of the Second, Seventh, Eighth, and Ninth Service Commands appointed available physicians with training in general public health to duty as industrial medical officers. It was necessary for the Surgeon General's Office to supply such officers to the Third, Fourth, Fifth, and Sixth Service Commands. Industrial medical activities in the First Service Command were of such minor nature that the assignment of a trained officer of this headquarters was not warranted.

Laboratories

Army Industrial Hygiene Laboratory.—The Army Industrial Hygiene Laboratory (pp. 169–185), authorized on 5 January 1942, by a directive from The Adjutant General, was to operate under supervision of the Occupational Hygiene Branch and was to be located at the Army Medical Center, Washington, D.C. Its location was changed to facilitate better staffing, and it was activated in October 1942 at The Johns Hopkins University School of Hygiene and Public Health. The laboratory, essentially an engineering laboratory, was intended to make surveys of environmental conditions in Army-operated plants. The service commands might request assistance from the laboratory in determining hazardous industrial conditions in any location. Surveys were to be made on a routine schedule decided by the Surgeon General's Office and the Army branch concerned. On the basis of these reports, it would be determined whether an industrial hygiene engineer should be assigned to a specific installation, and if considered necessary, such an assignment could be effected on request. A subsidiary laboratory was set up under the Chemistry Section of this unit to deal with the many problems of toxic exposure which were encountered in the Army.

Armored Medical Research Laboratory.—Rapid mechanization within the Army and the creation of the Armored Force in 1940 had raised a number of urgent problems related to the soldier's capacity to perform and indeed to survive under the hazards of tank warfare. With the encouragement and support of the Committee on Industrial Medicine of the National Research Council, the establishment of the Armored Medical Research Laboratory at Fort Knox, Ky., was authorized by the Secretary of War. It was officially activated in October 1942. Although it was an Army Ground Forces installation, The Surgeon General was responsible for providing equipment, personnel, and technical guidance. It was transferred to the jurisdiction of Army Service Forces in 1944 and was placed

under full control of The Surgeon General. From this time, the Occupational Health Division, Preventive Medicine Service, through its Occupational Hazards Branch, was charged with supervision. The varied activities of the Armored Medical Research Laboratory is discussed in that section (pp. 185-194).

Conference of Service Command Industrial Medical Officers, August 1942

On 10-11 August 1942, a conference of industrial medical officers attached to the service commands was held in the Surgeon General's Office. Certain subjects discussed at the meeting are of significance in that they demonstrate the degree of development of the newly organized program. Studies which had at first covered Army-owned and Army-operated plants were now being carried out by the U.S. Public Health Service in Army-owned, contractor-operated plants. Because of the special health problems peculiar to ordnance plants—manufacturing, processing, storing, or handling explosives, pyrotechnics, and propellants—the Explosives Safety Branch has been established in the Ordnance Department for control of accident hazards and internal security in these plants.¹⁰ Liaison between the Office of the Chief of Ordnance and the Surgeon General's Office had been established.

It had already become evident that the shortage of medical officers would necessitate the use of contract surgeons whenever possible in industrial plants. Service commands would be made responsible for hiring them. Medical Corps officers were to be used in industrial medicine only where adequate service could not be otherwise effected. Civilian nurses selected from those registered graduate nurses who were not eligible for duty with the Army Nurse Corps were to be used in the plants.

At this meeting, it was estimated that the Army owned and operated more than 160 plants, with a total employee population of approximately 400,000. It was pointed out that the Army's responsibility and duty toward these employees was no different from that of other employers; namely, to determine that (1) the employees are physically fit for the work they do; (2) the conditions under which they work are safe and sanitary; (3) adequate industrial medical service is provided, and (4) the employees injured on duty are reported to the U.S. Employees' Compensation Commission when indicated.

The responsibility of the War Department with respect to Government-owned, contractor-operated plants had been clarified by The Judge Advocate General of the Army who had stated that these plants should be classed as military reservations and that it would be the responsibility of the War Department to insure that adequate medical service and sanitary

¹⁰ (1) Ordnance Department Order No. 304, Office of the Chief of Ordnance, 14 July 1942. (2) Ordnance Department Order No. 286, ch. 3, Office of the Chief of Ordnance, 7 Oct. 1942.

conditions were maintained at them. The contractor was to supply, according to contract, his own medical personnel and equipment. Thus, the responsibility of the service command for such plants was limited to inspection to insure that the obligations of the War Department were met.

The many difficulties in operating a satisfactory industrial medical service were pointed out by such questions from the service command industrial medical officers as—

1. What action may be taken for correction of specific hazards and poor environmental sanitation found at the time of surveys or subsequent inspections?
2. What authority will the service commands exercise over the contractor of Government-owned plants?
3. What authority has the Medical Department to recommend employees for specified jobs on the basis of physical fitness?
4. Where should the records of the plant Medical Department be kept? (Before the inauguration of the industrial medical program, medical service was frequently a branch of the personnel department, and all records were in the custody of the personnel officer who decided eligibility for employment.)
5. What authority has the Medical Department to recommend rest periods, nutrition programs, and public health programs,
6. What is the responsibility of the service command with respect to Army Air Forces installations?
7. Should general standards of hygiene and environmental sanitation established by Army Regulations be used as a yardstick in Army-owned and Army-operated plants?
8. How much medical service should be given to persons injured or ill? Many of the physicians associated with the U.S. Employees' Compensation Commission cannot be contacted because they have become part of the Army Medical Corps.
9. To what extent should military hospitals be used for hospitalizing employees with service-connected injuries or illnesses?
10. Should home visits be made by plant Medical Department nurses for the reduction of absenteeism?
11. What is the policy on annual and periodic physical examinations?
12. Will the Surgeon General's Office publish a manual of industrial hygiene, thus supplying officers in the field with lists of toxic gases, fumes, and solvents and with methods of control of these hazardous substances?
13. Should the preemployment physical examination be limited to those items listed in Civil Service Physical Examination Form No. 2413?
14. What records should be submitted to The Surgeon General and should that office be informed of surveys made in the field?
15. Should industrial hygiene engineers be assigned to each service command?

These questions clearly indicated the need for a definite comprehensive policy for the industrial medical program. They also showed that some of the industrial medical officers in the service commands were unfamiliar with the standard practice of industrial medicine in plant dispensaries and that even those with adequate training and ability were hindered by Army routine and lack of authority to carry out their prescribed mission.

Initial Field Inspections

Colonel Lanza, as chief of the Occupational Hygiene Branch, was thoroughly cognizant of the urgent need for a directive to provide those in the field with adequate authority to accomplish the task assigned to them. However, it was believed that without thorough knowledge of the problems in the field derived from personal investigation any directive issued might be more harmful than helpful. Therefore, during the summer and the fall of 1942, inspections were made throughout the various service commands and at Army Air Forces installations.

During these inspections, it became obvious that the rapid expansion of the Army and the tremendous problems of establishing reception centers, basic training centers, additional hospitals and dispensaries, together with the dearth of medical officers, resulted quite naturally in the service command surgeons being primarily concerned with the men in uniform. To develop a program for civilian employees when it was difficult to maintain adequate hospital and dispensary service for soldiers was a formidable problem. These inspection trips by officers of the Occupational Hygiene Branch not only furnished data on which to base an adequate directive for the industrial medical program but also oriented them concerning the proper priority which should be assigned to that program. The trips also provided an opportunity to "sell" this new type of medical service to Regular Army Medical Department officers, who had never in their Army careers considered the care of civilians as part of their jobs.

Administrative and Other Activities

While these trips were being made, the Occupational Hygiene Branch also devoted its energies to developing the liaison maintained with the Office of the Chief of Ordnance to effect control of occupational health hazards in ordnance plants manufacturing, processing, storing, or handling explosives, propellants, or pyrotechnics; to the organization of the Army Industrial Hygiene Laboratory; to the preparation of standard Medical Department equipment lists for industrial dispensaries and aid stations; and to the preparation of working drawings for industrial dispensaries.

Equipment.—An equipment list was prepared after consultation with civilian industrial medical departments, service commands, and technical

services. On 26 January 1943, this list, Standard Medical Item 97256, Industrial Dispensary Equipment, was announced to Medical Department depots and certain Quartermaster Corps depots for use in a building where from 4,500 to 5,500 square feet were authorized by the Army Service Forces or Army Air Forces for dispensary use. There were two supplements to this item: The first was additional X-ray equipment provided with a photofluorographic attachment for taking 4- by 5-inch X-ray plates (to be issued only on approval by the Surgeon General's Office), and the second consisted of sufficient equipment and supplies to operate a small first aid room. Dispensary equipment was later designated Standard Medical Items 9625603 (Industrial Dispensary No. 1), 9625605 (Industrial Dispensary No. 2), and 9725610 (Industrial Dispensary Aid Station). The three standard equipment lists included sufficient expendable and non-expendable supplies to render emergency medical and surgical care, including emergency operations which could not satisfactorily await transportation to a hospital, adequate physical examinations, and such laboratory work as X-rays, urinalyses, and blood counts.

Throughout the entire war, very few changes in the original standard equipment list were necessary. When any specialized problems arose which required additional supplies, their issue depended upon decisions made in the Surgeon General's Office. No original equipment was issued without the approval of the Occupational Hygiene Branch. In this way, the Occupational Hygiene Branch remained in constant contact with and retained fair supervision over the aspect of the industrial medical program of the Army Service Forces and the Army Air Forces.

Dispensary design.—Early in 1940, an officer representing the Chief of Ordnance had consulted with representatives of the Preventive Medicine Division concerning medical dispensaries for those ordnance plants for which construction was then contemplated. Eight plans for these proposed industrial dispensaries were drawn up by the Hospital Construction Division, Surgeon General's Office. While no action was taken on them at that time, they were available to the Occupational Hygiene Branch when it later became necessary to standardize plans of an industrial medical dispensary. Two main types of structures (measuring 108 by 40 feet, and 140 by 40 feet, respectively) after slight modifications were approved by the Hospital Construction Division, Surgeon General's Office, and the Corps of Engineers as standard industrial medical dispensaries. Floor plans of standard U.S. Army industrial dispensary buildings are shown in charts 1 and 2. Shortly after standardization of these buildings, the Ordnance Department requested that industrial dispensaries be located in 16 new ordnance loading plants and depots. Industrial dispensaries were built also at some 40 other Army Service Forces installations and at least 13 large Army Air Forces depots (fig. 24).

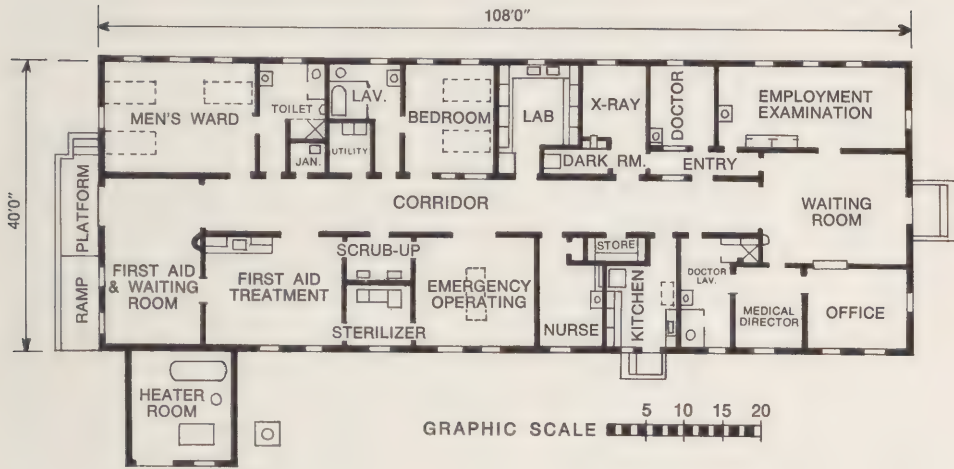


FIGURE 24.—Typical industrial dispensary.

The dispensaries proved satisfactory, although a few minor changes were made at almost every station. The emergency operating room, for instance, was not required where the installation had its own station hospital or where an existing Government hospital was within easy distance by ambulance. It was often used instead as a physiotherapy room. In smaller dispensaries, the X-ray apparatus was installed in this operating room and the small X-ray room used as a supply room or additional office. The chief complaint made concerning these dispensaries was the lack of adequate space for supplies.

As can be seen from charts 1 and 2, the floor plan for each dispensary was more or less divided into two parts—one for emergency medical and surgical care and the other for physical examinations and maintenance of records. It was found desirable to install X-ray equipment of not more than 100 ma., as there was little danger from operating such a machine. However, the smaller field X-ray unit of as low as 30 ma. did not provide sufficiently accurate chest plates because of the length of time required for each exposure. The amount of laboratory work done in the dispensaries varied, but it was the considered opinion of the Occupational Health Division that laboratory work of more definitive nature than urinalyses and blood counts was not generally required and that adequate space was afforded for blood chemical studies.

Where floorspace was available in existing buildings, an attempt was

CHART 1.—*Floor plan, industrial dispensary (type F-H)*

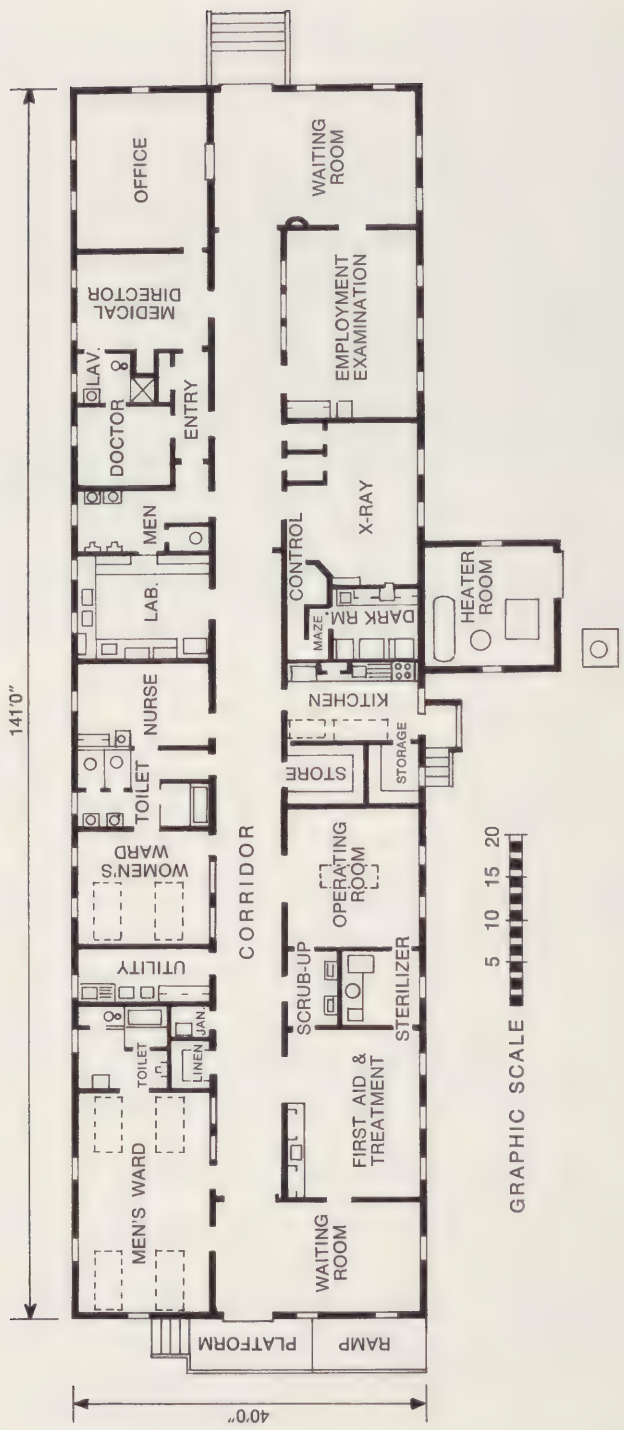
made to modify internal structure to correspond more or less to the standardized plans. Because of the difficulties of taking a sick or injured employee, or a handicapped person who had been advised against climbing stairs, to medical service requiring the use of stairs, it was the policy of the Surgeon General's Office to have all dispensaries and first aid stations located on the ground floor or in buildings where elevator service was available. Each dispensary building was supplied with at least two ambulances for the emergency transportation of sick and injured employees.

Personnel.—During this formative period, approximately 50 physicians trained in industrial medicine were commissioned in the Medical Corps and offered various service commands and to Army Service Forces and Army Air Forces installations. The Occupational Hygiene Branch was also responsible for commissioning qualified industrial hygiene engineers and chemists to fill the requirements of the Army Industrial Hygiene Laboratory, the service commands, and the Army Air Forces.

Publication of War Department Circular No. 59

Having solved the problems of supply, equipment, buildings, and personnel with which to carry out an industrial medical program, and having surveyed the headquarters of service commands and their Army Air Forces and field installations, the Occupational Hygiene Branch had acquired sufficient data on which to base the preparation of a general directive concerning the Army industrial medical program. Although frequent conferences were held with representatives of all interested agencies, there was confusion in the Surgeon General's Office on the authority of that office to

CHART 2.—Floor plan, industrial dispensary (type G-H)



publish such a general directive, since The Surgeon General was a staff officer of the Commanding General of the Army Service Forces and had no direct connection with the medical activities of the Army Air Forces. The latter, however, agreed to cooperate with the Occupational Hygiene Branch.

It was eventually decided to publish a War Department circular defining the scope, responsibilities, and methods of operation of an industrial medical program in the field. Because of the complexity of command responsibility encountered in the industrial medical program for all War Department activities, the original directive was most difficult to prepare. For example, the Commanding General, Army Air Forces, did not have an industrial medical program in all Army Air Forces depots and did not feel that one was indicated. Thus, the industrial medical program of the Army Air Forces was limited to what was at that time designated as the Air Service Command, which operated 11 major depots where aircraft of all types were modified or repaired. These depots were located in strategic places throughout the United States, and numerous satellite subdepots reported to them.

The commanding generals of the service commands were responsible for operating the industrial medical program in class IV installations (p. 108) of the Army, with the following two exceptions: (1) Those plants which manufactured, processed, stored, or handled pyrotechnics and explosives, where the service commands maintained the medical service but were not responsible for inspection and recommendations concerning the control of safety hazards; and (2) the ports of embarkation where the medical service was entirely independent of the service commands. Despite these difficulties, on 24 February 1943, War Department Circular No. 59, "Industrial Medical Program of United States Army," was published as the first general directive concerning the Army industrial medical program.

EXTENSION OF THE PROGRAM

The War Department's responsibility for medical care of its civilian employees was stated in War Department Circular No. 59 in the following terms:

As an employer, the Army is obligated to furnish safe and hygienic working conditions and to maintain an adequate industrial medical service. * * * The Surgeon General will make all necessary provisions for the supervision of industrial hygiene and for the emergency treatment of military personnel and civilian employees at Army-operated industrial plants.

In effect, therefore, an industrial medical service was provided for all civilian employees who worked at certain installations (class IV) regardless of whether their assignment included hazardous or nonhazardous work. No other employees of the War Department were included under this care.

The Surgeon General was subjected to continuous pressure from nu-

merous sources (particularly Civilian Personnel Divisions, Army Service Forces, and the Office of the Secretary of War) to extend the Army's industrial medical program to cover all employees of the War Department.

The Surgeon General discouraged this extension of the program. His stand was based particularly on the scarcity of medical officers and other professional personnel, as well as supplies and equipment. Furthermore, since the service was offered to industrial installations, approximately 85 percent of those employees who might require the service received it, and many others were stationed at posts where there were military Medical Departments from which necessary emergency medical care could be obtained.

Civilian employees in the Pentagon.—The first action taken by the Occupational Hygiene Branch in regard to medical care for civilians was in furnishing consultant advice to the director of the Civilian Personnel Division, Office of the Secretary of War. In the early part of the war, it became obvious to that office that some sort of a civilian medical program would have to be established for employees of the War Department in the Pentagon. This building, housing approximately 40,000 employees, was located across the Potomac River from Washington, D.C., and was therefore isolated, so that excessive "time off" was required for employees to visit personal physicians in the city.

The Surgeon General was consulted as to the possibility of extending his industrial medical program to care for these employees. It was believed that the Medical Department should not furnish such a civilian medical service because in offering care to this specific group, it would thus be obligated to provide the same service for all civilian employees of the War Department. However, the Director, Civilian Personnel Division, Office of the Secretary of War, conferred frequently with the Chief, Occupational Hygiene Branch, Surgeon General's Office, and the latter implemented the assignment of a medical director to the War Department, advised concerning the type of dispensary needed in the Pentagon, and assisted in estimating floorspace and equipment.

In December 1942, a civilian medical program was established for the employees in the Pentagon.¹¹ This program was considered part of the overhead expense of the Office of the Secretary of War and did not depend on any budget established for civilian medical service. The medical unit was equipped and staffed to offer preventive and consultative health services and to serve employees on matters of health education. It did not undertake treatment but determined the medical needs of employees and assisted them in selecting a private physician if treatment was required. It was desired to "coordinate and standardize efforts to improve nutrition, correct faulty industrial hygiene, and cultivate a prideful sense of responsibility in personal health to increase efficiency and reduce absenteeism." The first di-

¹¹ War Department Administrative Memorandum No. 72, 20 Dec. 1942.

rector of the Pentagon employees medical service was Dr. Fredric C. Smith, retired Assistant Surgeon General of the U.S. Public Health Service.

Pressure for inclusion of other War Department employees.—Another phase of extension of the program occurred while this service for the Pentagon was in its formative stages. The Office of Dependency Benefits, which had been part of the Adjutant General's Office, Washington, D.C., was moved to the Prudential Life Insurance Co. building, Newark, N.J. Just before the move, The Adjutant General ordered that there be combined into one general dispensary installation an Army dispensary and the services and facilities that could be provided at that time by the Office of the Secretary of War for the civilian personnel. The Surgeon General's Office was not informed of this action. On receipt of this directive, the commanding general and the surgeon of the Second Service Command set up a dispensary. However, they requested instructions as to whether all other War Department administrative civilian employees in the service command should be treated in similar manner. Because of rigorous demands on medical personnel, The Surgeon General could no more than maintain his stand of discouraging such expansion.

The Surgeon General thus became increasingly involved in the question of extending his program for medical care of civilian employees of the War Department.

In March 1943, the Commanding General, Army Air Forces, requested information on procurement of medical equipment and supplies for first aid treatment of civilian employees of the Army Air Forces Procurement Division and allied offices and an opinion on whether first aid treatment should be given these civilians. The Surgeon General offered assistance in working out plans for necessary services, but as the allotment of medical personnel was so curtailed, he was unable to give professional assistance in handling such first aid work. He forwarded the correspondence to the Commanding General, Army Service Forces, who endorsed it, commenting that where emergency medical treatment for civilian employees of the Army was not available it was provided through the U.S. Employees' Compensation Commission.

The attitude of The Surgeon General toward this problem of extension is easily understood when it is realized that higher authorities continually disapproved his requests for the additional professional service necessary to provide such medical care. As of May 1943, over 100 medical officers were already employed in the industrial medical program, and expansion of the program seemed impossible in the light of the serious shortage of commissioned medical personnel for assignment to the care and treatment of military personnel.

At that time, the Director, Military Personnel Division, Army Service Forces, recommended that the assignment of military medical personnel to civilian industrial enterprises be avoided except in cases of extreme emer-

gency justified in each case, and further, that the maximum number provided for this service be held within 100 Medical Corps officers.

Despite this recommendation, on 22 June 1943, the chief of the Occupational Hygiene Branch addressed to The Surgeon General a memorandum referable to further extension¹² which illustrated the urgency with which the Medical Department was being exhorted to expand its industrial medical program. This memorandum called attention to the number of times that the question of expansion had been raised by organizations within the War Department, including the Civilian Personnel Division, Army Service Forces, installations of the Engineer Board, and the Office of Dependency Benefits. It pointed out that while approximately 730,000 industrial employees were at the time under the industrial medical program, some 600,000 War Department civil service employees were not. It stated that—

* * * expansion of emergency medical care to include all of the employees of the War Department under the unified control of the Surgeon General's Office would constitute a satisfactory and adequate fulfillment of the responsibility which the War Department has for its civilian employees.

In the same month, the Occupational Hygiene Branch proposed the issuance of a War Department circular to the effect that The Surgeon General would be responsible for emergency medical care of civilian employees of the War Department not included in War Department Circular No. 59. This was disapproved by The Surgeon General on the grounds that the Medical Department had neither the personnel nor the funds to carry it on, a position which he consistently maintained.

Civil service status for contract surgeons and civilian physicians.—One problem that had arisen out of the shortage of medical officers was that of finding adequate numbers of civilian physicians to fill the needs of the industrial medical program. In the early stages of the war, the only means whereby civilian physicians could be procured and assigned to War Department installations had been by recruitment of contract surgeons. Because of the increased demand for physicians in civilian communities, few were interested in becoming contract surgeons, especially when there was no opportunity for advancement in grade, which meant that pay could be increased only 5 percent each 3 years in service. In the latter part of 1942, as a means of combating this situation and providing pay comparable to that offered for similar work in civilian industry, the Surgeon General's Office instigated the publication of War Department Circular No. 2, dated 1 January 1943, section II of which authorized the employment of medical personnel on a civil service status.

As a result of this circular, numerous contract surgeons were transferred to P-4 and P-5 civil service grades, and even though the War De-

¹² Memorandum, Lt. Col. A. J. Lanza, MC, Chief, Occupational Hygiene Branch, for The Surgeon General, 22 June 1943.

partment was never able to compete in salary with civilian industry, the opportunity of persuading doctors to remain on duty in War Department industrial plants was definitely increased. It was estimated that, by the fall of 1943, approximately 120 contract surgeons and civilian physicians were so employed, in addition to the 125 Medical Corps officers who were working in this program in the larger installations and in those areas where it was impossible to hire civilian physicians. Most of the contract surgeons and civilian physicians were elderly men who could not stand the rigors of a busy practice. Many had not previously practiced industrial medicine, so that at times, they experienced difficulty in adapting themselves to the job. However, they were extremely patriotic and should be highly commended for accepting these positions as a contribution to the war effort, and in many cases, at a financial sacrifice to themselves.

As this group was gradually incorporated in the industrial medical program, the service commands, the Army Air Forces, and the technical services were in a better position to accept expansion of the industrial medical service without the assignment of additional medical officers. A recommendation that they be appointed as civilian consultants to The Surgeon General, and as such be paid \$20 a day for their services, was disapproved by the Commanding General, Army Service Forces.

Extension of service to all Army Service Forces installations, June 1945.—In the spring of 1945, after an extensive survey of the service commands, which revealed that they were agreeable to extension of the medical service to all civilian employees, conferences were again held by representatives of the Army Service Forces, the Surgeon General's Office and the Office of the Secretary of War. As a result, Army Service Forces Circular No. 242, dated 27 June 1945, was published outlining the type of emergency medical treatment to be provided for civilian employees of the Army Service Forces, the allowances of necessary medical supplies, and the manner in which they would be obtained. Reference was made to War Department Circular No. 175, dated 12 June 1945; War Department Circular No. 198, dated 20 May 1944, as amended by section I, War Department Circular No. 242, dated 14 June 1944; and paragraph 2c(4), AR (Army Regulations) No. 40-505, 1 September 1942.

Authority was granted to Army Service Forces installations, other than those referred to in the latter two publications, to provide emergency first aid treatment by means of civilian nurses until such time as private physicians could be obtained.

Ports of Embarkation

The industrial medical program as defined in War Department Circular

No. 59 did not include those activities of an industrial nature which were the responsibility of the Office of the Chief of Transportation.

The chief of the Occupational Hygiene Branch, Surgeon General's Office, surveyed the New York Port of Embarkation in August 1943. In his report to the Chief of Transportation, it was recommended that ports of embarkation be considered by the Surgeon General's Office as industrial installations, and holding and reconsignment points as depots, and that the program outlined in War Department Circular No. 59 apply to them. No increase in allotment of medical officers could be made for the institution of industrial medical programs at the ports. The Transportation Corps, however, had its own allotment of Medical Department personnel—port surgeons who reported through the commanding general of each port and the Chief of Transportation to a medical liaison officer from the Surgeon General's Office.

Compliance with provisions of War Department Circular No. 59 at ports of embarkation was ordered. Port commanders were directed to determine their requirements to institute an adequate industrial medical program and were informed that necessary technical assistance might be requested from The Surgeon General.

Authorization of funds, buildings, and equipment necessitated the approval of the Commanding General, Army Service Forces. Although The Adjutant General at first asserted that ports of embarkation were not industrial installations, this decision was reversed. The commanders of the ports of Boston, New York, Hampton Roads, New Orleans, Los Angeles, San Francisco, and Seattle took immediate steps to establish an industrial medical program.

New York.—Cooperation on the part of the Office of the Chief of Transportation concerning the industrial medical program was always outstanding, and inspections by representatives of the Surgeon General's Office at the ports revealed that the program had been accepted and promulgated with the greatest efficiency. For example, during a survey of the New York Port of Embarkation in September 1944, it was discovered that 9,000 square feet of floorspace had been set aside at the Brooklyn Army Base for the main port dispensary. Medical service for the 32,000 employees of the port was provided by an industrial medical officer, eight civilian physicians, 12 nurses, and five medical technicians. Here, emergency medical service was also rendered to civilian merchant marine personnel and contractor employees (such as longshoremen employed by a stevedore who had contracted with the port to accomplish a loading job). Adequate physical examinations were provided for civilian employees of the War Department going overseas.

Besides the main dispensary, others were located at City Island, Port Johnston, Staten Island Terminal, Caven Point, and Bush Terminal. Civilian personnel in the staging areas of Camp Kilmer, Camp Shanks, Fort

Hamilton, and Fort Slocum all received service outlined by War Department circulars covering the industrial medical program. During August 1944, 17,978 patients received 22,472 treatments at the New York Port of Embarkation. The civilian personnel department of the port remarked on the improvement in morale and reduction in lost time incident to the handling of accidents and illnesses. The commanding general and the port surgeon both commented on the importance of the program in "moving more tons per man per day."

San Francisco.—At the San Francisco Port of Embarkation approximately 100 persons were employed in the Industrial Medical Department. Its dispensary was one of the most modern and complete and was commended by the American College of Surgeons (fig. 25). In addition to op-



FIGURE 25.—Industrial dispensary, San Francisco Port of Embarkation. A. Exterior view, main dispensary. B. Treatment room, dispensary, building 124. C. Dispensary in the receiving and assembling warehouse, Fort Mason. D. Dispensary on pier 37.

erating a program equal to any found in private industry, the industrial medical officer, Lt. Col. Jean Spencer Felton, MC, published a manual of industrial medicine which the Chief of Transportation later supplied to all other ports.¹³ He also held classes for his entire staff on the principles and practices of industrial hygiene.

Port surveys.—An industrial hygiene survey was made in every major port in the United States,¹⁴ and the percentage of compliance with recommendations made was high. In rewriting the War Department circular on the industrial medical program (War Department Circular No. 198, 20 May 1944), ports of embarkation were definitely included in the Army's industrial medical program.

All holding and reconsignment points also initiated industrial medical programs similar to those found in the ports. One problem emerged in establishing the medical installations—most holding and reconsignment points were located at depots which were operated by branches of the technical services on property assigned to the Chief of Transportation. As a result of cooperation between the Chief of Transportation and the service commands, a central general medical program was established for civilians on these posts, and thus duplication of effort was avoided.

Army Industrial Hospitals in Remote Areas

In the fall of 1942, the commanding officers of certain Army-owned and Army-operated ordnance depots in isolated or remote areas raised the question of the difficulty they were likely to encounter in recruiting employees if medical service and hospitalization were not offered in addition to the living quarters, stores, schools, and churches which were contemplated. These installations were Tooele Ordnance Depot, Tooele, Utah, and Sierra Ordnance Depot, Herlong, Calif. The only hospital available to Tooele was in Salt Lake City, Utah, 55 miles distant. Sierra Ordnance Depot was an equal distance from Reno, Nev., and near no other town of any size. The Ordnance Department was asked for information on other proposed remote ordnance depots, and it was learned that six similar depots would be located in isolated regions for the purpose of storing high explosives and that the problem of provision of medical care for civilian employees and their dependents would be similar in all these depots.

On the basis of this information, The Surgeon General advised the Secretary of War that these isolated installations posed a problem in the provision of medical care which had no precedent and which had to be dealt with promptly to avoid undue delay in the production or storage of essential munitions. Furthermore, the civilian personnel divisions of the Office of the Secretary of War, the Army Service Forces, the Ordnance De-

¹³ Standard Operating Procedure of the Industrial Program, San Francisco Port of Embarkation, 1944.

¹⁴ Chronological list of surveys, Army Industrial Hygiene Laboratory, October 1942 to June 1945.

partment, and the Surgeon General's Office agreed that facilities for the medical care of civilian employees should be expanded in order that medical care, including hospitalization, be available to civilian industrial employees and their families as the need might arise. Employees were to pay for any service other than that rendered for service-connected or emergency injuries and illnesses. It was admitted that the enactment of such a program of medical care for industrial employees of these plants and their families, including those living in dormitories and trailer camps, would necessitate the formulation of a new policy by the War Department and that other plants throughout the United States might fall within this category.

A War Department conference was arranged by The Surgeon General to define policies, both administrative and financial, to deal with these urgent situations. The meeting was held on 15 January 1943 and was attended by representatives from the Assistant Chief of Staff, G-4; Civilian Personnel Division, Office of the Secretary of War; Civilian Personnel Division, Services of Supply; Office of the Chief of Ordnance; Office of the Chief, Chemical Warfare Service; Office of the Chief of Engineers; Office of The Provost Marshal General; the Air Surgeon; Control, Services of Supply; and the Surgeon General's Office. The Army branches concerned were requested to state those plants and offices which would require special service of the type just described.¹⁵

A letter was sent to the Chief of Staff, Services of Supply, requesting that hospitals be approved for the following six ordnance depots with location and populations as follows:

1. Sierra Ordnance Depot, Herlong, Calif. (3,000 employees), 40 miles from Susanville, Calif. (1,600 population), 56 miles from Reno, Nev. (22,000 population).
2. Umatilla Ordnance Depot, Oreg. (2,500 employees), (fig. 26) 8 miles from Hermiston, Oreg. (2,000 population), 40 miles from Pendleton, Oreg. (11,000 population).
3. Black Hills Ordnance Depot, S. Dak. (2,500 employees), 11 miles from Edgemont, S. Dak. (1,000 population).
4. Tooele Ordnance Depot, Utah (4,200 employees), 2 miles from Tooele, Utah, (5,000 population).
5. Sioux Ordnance Depot, Nebr. (2,500 employees), 11 miles from Sidney, Nebr. (5,000 population).
6. Navajo Ordnance Depot, Ariz. (2,500 employees), 12 miles from Flagstaff, Ariz.

The total population, including industrial workers and their families, at these reservations was expected to vary from 4,500 to 8,000.

It was planned that a standard hospital unit of 35- to 50-bed capacity would be utilized. The estimated cost of construction of these hospitals was

¹⁵ Minutes, Conference on Policy for Medical Treatment of Civilian Workers and Their Families, 15 Jan. 1943.

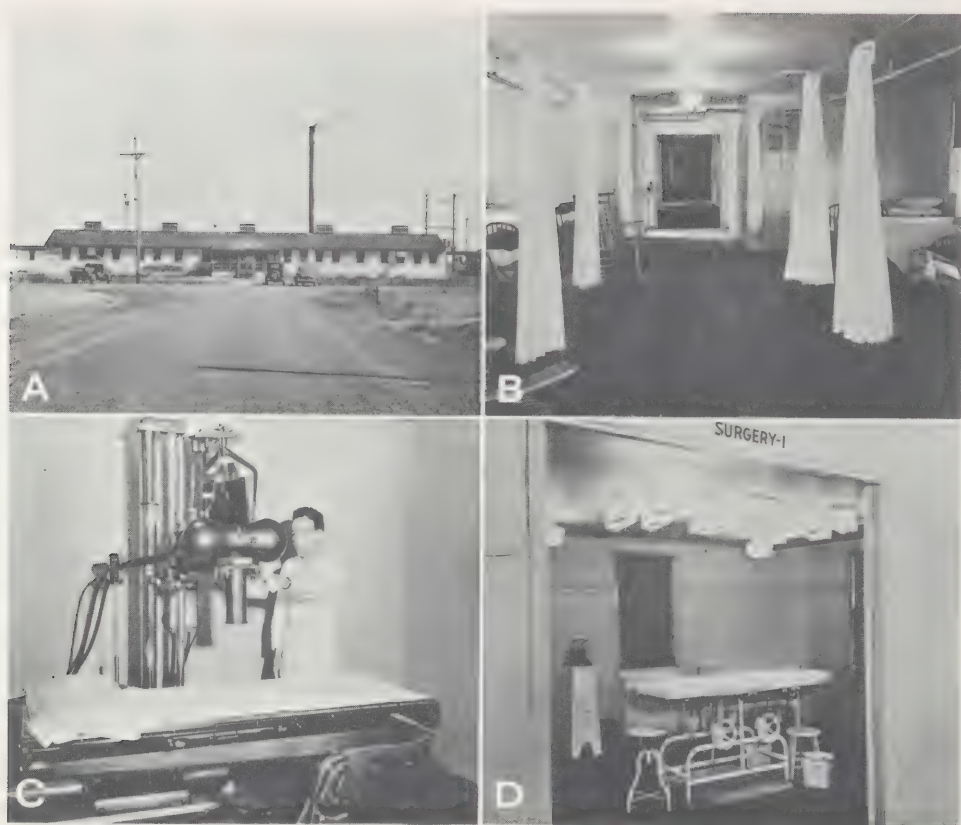


FIGURE 26.—Army industrial hospital in remote area (Umatilla Ordnance Depot, Oreg.).
A. Exterior view. B. Women's ward. C. X-ray room. D. Operating room.

approximately \$1 million. The salary of physicians and hospital personnel and cost of equipment was estimated at \$1.25 million. It was stated that "no arsenal or depot will be considered to come within the scope of the program herein proposed without personal investigation by a representative from the office of the chief of the Army branch concerned, and from the Surgeon General's Office." This request for the six hospitals was approved by the Secretary of War.

With the assistance of the Fiscal Division, Office of the Secretary of War, it was discovered that during the construction by the Government of certain irrigation project dams and flood control work, Executive Order No. 9066, 12 February 1942, "Authorizing the Secretary of War to Prescribe Military Areas," was issued which permitted the U.S. Government to supply medical service and hospitalization for civilian employees on these projects. It was pointed out in conferences that private mining and lumber industries, because of the isolated areas in which they were located, for

some time had rendered this type of service. Thus, the U.S. Government and the War Department, in establishing such a medical service, would not be setting a precedent for industry as a whole.

The proposed plan was presented to the American Medical Association. There was no dissent on the part of that association, provided that the basis for instituting such medical service would be that adequate existing civilian medical care was not available in the areas involved.

The foregoing description of the procedure followed in expanding the type of service rendered to civilian employees of Army industrial plants sounds very simple, and the steps leading to its accomplishment follow in a most orderly fashion. Actually much effort on the part of the Occupational Hygiene Branch was necessary to effect establishment of this policy by the War Department.

It was considered by the Occupational Hygiene Branch that the acceptance of this expanded type of medical care was further proof that the War Department was discharging its responsibility for its civilian industrial army, and that the Army industrial medical program was on a more sure and firm foundation.

Disapproval of further projects.—During the spring of 1943, The Surgeon General requested that similar medical care be provided for employees at the Spokane Air Depot, Wash., and Warner Robins Air Depot, Ga.; in July 1943, he further requested that Mount Rainier Ordnance Depot, near Tacoma, Wash., be included in this list. After careful study, the War Department General Staff eventually approved the use of the existing Warner Robins Military Hospital for care of civilian employees and their dependents at that depot, and disapproved the other two locations. Disapproval was based on the fact that hospital projects for cities in the vicinities of those depots had been requested through the Federal Housing Authority.

Cost of remote area hospitals.—By the fall of 1943, six remote area hospitals were in operation: Three 50-bed station hospitals at Black Hills Ordnance Depot, Sioux Ordnance Depot, and Navajo Ordnance Depot, respectively, and three 50-bed station hospitals with 25-bed expansion units each at Sierra, Tooele, and Umatilla Ordnance Depots. According to the Medical Supply Catalogue, the cost of this equipment was \$219,114. The operating cost of these hospitals from December 1943 to May 1945 amounted to \$676,849, making the total operating and equipment costs \$895,963. Construction costs were not available to the Surgeon General's Office.

The average net cost per patient day per hospital for the period from December 1943 to April 1945, inclusive, was \$15.38. It must be remembered, however, that these hospitals also served military personnel and their dependents, and very moderate fees were received from the civilians using the hospital. Though the cost per patient day in these hospitals was considerably above the national average, it certainly was not exorbitant.

when viewed in the light of military necessity. Although small hospitals were expensive to operate from the standpoint of personnel and equipment, the service that the six hospitals rendered can be considered necessary to the operation of the remote area depots.

It was contemplated that the Army's responsibility for these six hospitals would be discontinued as soon as the reduction in employee population at the plants warranted or when the local medical societies indicated willingness to assume this task.

Industrial Medicine in Occupied and Friendly Countries

On numerous occasions, during the formative period of the industrial medical program, the question was raised of whether The Surgeon General's responsibility in this field of preventive medicine would be expected to extend to overseas theaters of operation when and if the U.S. forces began to occupy either friendly or enemy territory. The Occupational Health Division was informed at first that no such expansion of the program was contemplated. It was not long, however, before the global character of the war was realized, and the problems of civilian employment became crucial. The United Kingdom was utilized as an immense storage depot as well as for the training of U.S. troops, the invasion of North Africa took place; U.S. Army Forces landed in Australia and in the Southwest Pacific islands; action was undertaken in the China-Burma-India theater; and as a result, great numbers of foreign civilians were employed by theater commanders as dockworkers, truckdrivers, cooks, servants, and general laborers in the many activities required by the supply services and the fixed installations of these areas.

When U.S. Army Forces landed on Luzon, P.I., and entered Manila, an additional problem presented itself—that of responsibility to the Commonwealth of the Philippines. Within a short time, more than 200,000 Filipinos were working for the U.S. Army. Their food and water supply had been controlled improperly for so long by the Japanese that tuberculosis and other endemic diseases of this area were rampant. During this time, also, the Army established ordnance, quartermaster, and signal corps repair shops and industrial plants on the continent of Europe, hiring foreign nationals as industrial employees.

A new office for overseas civilian personnel was established in the Office of the Secretary of War, and the U.S. Employees' Compensation Commission began to establish headquarters offices in these foreign countries. Their purpose was not only to enlist American civilians for duty at these overseas bases but also to carry out the provisions of the U.S. Employees' Compensation Act of 7 September 1916, under which the U.S. Government assumes certain responsibilities for all civil service employees.

Responsibility of The Surgeon General.—Conferences were held by the members of the Occupational Health Division with representatives of the two aforementioned agencies to discuss the responsibility of The Surgeon General in these matters. It was the considered opinion of those who attended the conferences that the War Department did have a responsibility toward foreign nationals employed by the U.S. Government; however, the Office of the Secretary of War held that the commanding generals of the theaters were adequately carrying out their responsibilities in this regard. Emergency medical care was rendered to any civilian who was injured or became ill as a result of his employment by the Government.¹⁶ It was admitted, furthermore, that much time was wasted because of mass hiring of available persons regardless of whether they had infectious or contagious diseases and that the problem of general public health was becoming a matter of great concern, especially in the winter of 1944–45.

In view of these facts, it was deemed essential that The Surgeon General state his position, and on 30 April 1945 a letter, prepared by the Occupational Health Division, Surgeon General's Office, was addressed by the director of Civilian Personnel and Training, Office of the Secretary of War, to commanding generals of overseas theaters, ports of embarkation, the Army Service Forces, and the Transportation Corps. In effect, it called to their attention that civilian employees of the War Department in theaters of operations were entitled to the rights and privileges of other U.S. Government employees and that the War Department was obligated not only to provide emergency medical care for them but also to control occupational health hazards to which they were subjected.

No requests were received in the Surgeon General's Office for assistance in this problem of dealing with civilian industrial employees in foreign countries until V–J Day. However, during conferences held in the Surgeon General's Office in August 1945 when the plans for the proposed invasion of Japan were being made, the chief of Preventive Medicine, Pacific theater, Lt. Col. (later Col.) Maurice Pincoffs, MC, discussed with representatives of the Occupational Health Division the problem of care of the Filipinos in and around Manila. The manner in which industrial health had been handled in this country was thoroughly explained to Colonel Pincoffs, and a memorandum on this subject was presented to him.¹⁷

It was recommended that general physical screening of civilian employees be attempted to prevent the assignment of persons with an infectious disease to work which would permit the spread of endemic or contagious diseases. Such a program could be effected with a limited number of personnel by an inspection of all new employees and a check on those

¹⁶ Letter, The Surgeon General, to Secretary of War, 11 Apr. 1945, subject: Health Measures for Civilian Employees of Army-Operated Industrial Plants in Theaters of Operation.

¹⁷ Memorandum, Director, Occupational Health Division, Surgeon General's Office, for Col. Maurice Pincoffs, MC (Chief, Preventive Medicine, Pacific theater), 8 Aug. 1945, subject: Medical Department Activities With Respect to Civilian Employees of the War Department in the Manila Area.

already employed when they appeared at dispensaries for treatment of illness or injury. Emergency medical and surgical care could also be handled by a minimum of medical officer personnel and a corps of properly trained civilians. Control of occupational health hazards could also be effected if a request were sent to the Surgeon General's Office for the assignment of personnel trained in this field.

Evaluation of the overseas program.—The Occupational Health Division believed that a more adequate program in overseas bases should have been and could have been established and that the basic plan for future operations in foreign areas ought to include more competent means of medical and engineering control of industrial operations wherever troops are so engaged and civilian employees assist them.

ACTIVITIES OF THE OCCUPATIONAL HEALTH DIVISION

During the several organizational changes of the Preventive Medicine Service in the war years, similar changes in status were undergone by the occupational hygiene unit, and a much wider range of activities was embraced. In the early period, the Chief, Occupational Hygiene Branch, Surgeon General's Office, administered and supervised industrial medical and industrial hygiene service for civilian workers in Army-operated and contractor-operated arsenals, depots, and industrial plants, and he directed the activities of the Army Industrial Hygiene Laboratory. Two Medical Corps officers were assigned to the Occupational Hygiene Branch.

In January 1944, the Occupational Hygiene Branch became the Occupational Health Division with four branches (later consolidated into three).¹⁸ Four officers, three Medical Corps and one Medical Administrative Corps, were assigned. The organization remained at this level until the close of the war with Japan, when the functions and activities of the Occupational Health Division were transferred to the Army Industrial Hygiene Laboratory, Edgewood Arsenal, Md.¹⁹

The activities of the division, in common with others of the Preventive Medicine Service, may be divided into two principal phases: Administrative (including field work) and investigative. The research program under the Occupational Health Division's direction will be discussed in subsequent sections.

Administrative Activities

The administrative activities included establishing policy with respect to the industrial medical program, maintaining a consultative service in

¹⁸ (1) Memorandum, Director, Occupational Health Division, Surgeon General's Office, for Chief, Preventive Medicine Service, Surgeon General's Office, 20 Jan. 1944, subject: Plans and Recommendations for the Administration of the Occupational Health Division. (2) Memorandum, Director, Occupational Health Division, Surgeon General's Office, for Executive Officer, Preventive Medicine Service, Surgeon General's Office, 28 Aug. 1944.

¹⁹ Office Order No. 253, Surgeon General's Office, U.S. Army, 25 Sept. 1945.

the field of medical toxicology, and implementing recommendations of the Armored Medical Research Laboratory.

The Occupational Health Division represented an activity which was entirely foreign to previous experience of the Medical Department and which was subject to question by higher headquarters and various echelons of the Army. Further, the activity was established at a time when medical and other personnel were at a premium. Consequently, much effort was expended in reviewing the actual shortages of medical personnel, both civilian and military, to determine the urgency of the occupational health program in relation to that of other activities of the Medical Department so that reasonable recommendations as to priorities of the program could be made to higher authority. Policies formulated in this program were always discussed with, and had the approval of, the American Medical Association and such local medical societies as were involved in specific instances. After the initial recommendations and those constantly necessitated by increased expansion of activities incident to the rapidly expanding industrial program were effected, there still remained the problems encountered in implementation of these activities through the various Army echelons and in cooperation with the civil agencies involved.

Field Inspections

At least one-fifth of the time of the director and assistant director of the Occupational Health Division during the entire war was spent in the field. Inspection trips were made in service command headquarters and specific industrial installations on a schedule which attempted to cover trouble spots and important areas on a yearly basis.

Mild criticism of this inspection policy was voiced on occasion. However, the field trips were considered important for several reasons: The industrial medical program can be said to have been in a formative period throughout the war, and the acceptance and proper establishment of the principles and the practices of this type of medical service required explanation and considerable salesmanship on the part of The Surgeon General's representatives. In addition, the constant rotation of officers in the field stations or at service command headquarters produced many situations wherein directives were not received or satisfactorily understood, and the means of implementing policies were not known. Frequently, the establishment or construction of more adequate dispensaries and the securing of equipment and personnel necessary for satisfactory operation of the program were delayed until it was known in the field that The Surgeon General would approve requests for such improvements. Conferences held in the service command headquarters or at the installations themselves helped to clarify many of these points.

One other important advantage of these trips was that the officers of the Occupational Health Division thereby became thoroughly conversant with the problems confronting the field installations and thus were better able to prepare directives which could be carried out in the field. Experience showed that the time spent was well worthwhile. By way of illustration, part of a letter, written on 4 August 1945, to the Commanding General, Army Service Forces, from the Surgeon, Ninth Service Command, is quoted:

This office is deeply appreciative of the visit recently made by * * * the Director, Occupational Health Division, to this Service Command. Besides conferences in this office, 25 stations were visited directly and 15 others indirectly by consultation with the officers responsible for industrial medical service in those other stations. [The Director's] * * * visit covered approximately 5,000 miles within the Service Command over a period of 14 days.

Many industrial medical problems were discussed and our medical officers, most of whom have had no formal training in industrial medicine, felt these discussions were extremely helpful to them. It has been particularly useful to have [the Director] visit our four remote area hospitals, located at large Ordnance depots in rather isolated areas, because special understanding is required in handling their problems. [The Director's] visit has done a great deal to add impetus to our industrial medical program * * *.

Publications

Revision of War Department Circular No. 59 (1944).—To clarify certain problems which had arisen in field installations because of difficulty in interpretation of War Department Circular No. 59, dated 24 February 1943 (pp. 115–117), and to include the ports of embarkation in the Army industrial medical program, a revision of this circular was published on 20 May 1944 as War Department Circular No. 198. This was the second attempt to define the Army industrial medical program and its scope. Shortly after publication, it was realized that even this attempt had its drawbacks and mistakes and that officers in the field still lacked the fundamental guidance required to implement the program properly at the service command and installation levels.

Improvement of reporting system (1945).—Although the industrial medical program had been operating since 1942, the only information that had been received from the field by which the success of the program could be estimated was the return of the "Semiannual Occupational Hygiene Report" (WD SGO Form No. 123, 21 April 1943). This report had been requested to determine personnel requirements and to obtain information on matters of supply and equipment. These data were essential to the Occupational Health Division to approve or disapprove requests for nonstandard items at industrial installations. The Army Service Forces believed that too many periodic reports from field installations were being requested by the Surgeon General's Office and on numerous occasions had refused to approve additional ones. The Surgeon General was in a position of supervising an

industrial medical program for which the 1944-45 budget estimate was approximately \$9 million, and of being unable to provide the following specific information:

1. The total number of Army-owned and Army-operated installations coming within the scope of the industrial medical program.
2. The total number of civilian employees for whom this program was established.
3. The number of medical officers, civilian physicians, contract surgeons, nurses, technicians, and other personnel required to operate the program.
4. The cost of the program.
5. The number of treatments, preplacement examinations, periodic examinations, and other activities of industrial dispensaries.

This problem, which resulted from the lack of a careful reporting procedure as related to the program, was explained by officers of the Occupational Health Division at numerous conferences attended by representatives of the Control Division, the Surgeon General's Office; the Control Division and the Industrial Personnel Division, Army Service Forces; and the Civilian Personnel Division, Office of the Secretary of War. While the situation was admittedly undesirable, the Control Division, Army Service Forces, maintained that the reports arriving from the field should be a sufficient source of information. It was pointed out, however, that none of these reports provided the specific information required, although the monthly report to the U.S. Employees' Compensation Commission did contain data on the number of treatments given.

Finally, at the instigation of The Surgeon General, the Director, Control Division, Army Service Forces, early in 1944 requested that a one-page proposed occupational health report form be submitted. It was to be prepared quarterly by each installation that fell within the scope of War Department Circular No. 198 and was to contain information from which could be derived the necessary statistical data concerning the industrial medical program. The proposed form was approved (WD AGO Form No. 8-177, "Quarterly Occupational Health Report") and supplanted the "Semi-annual Occupational Health Report."

Army Service Forces Manual M210 (1945).—It was also proposed to the Control Division, Army Service Forces, on 21 July 1944, that since each installation of necessity would have to maintain records to compile this report, a standard procedure should be established. Approval was granted on 10 January 1945, and Army Service Forces Manual M210, "Operating Procedures for Industrial Dispensaries," was published in March by Headquarters, Army Service Forces. This manual was distributed to the service commands and the installations of the Transportation Corps, to-

gether with certain standard forms.²⁰ The establishment by 1 May 1945 of the procedures described in the manual was directed by Army Service Forces Circular No. 134, dated 14 April 1945.

The acceptance of this manual by all field installations, service command headquarters, and the Office of Chief of Transportation was immediate and excellent. Numerous civilian agencies and the U.S. Civil Service Commission requested extra copies. The latter stated unofficially that it wished to organize the future industrial medical program of the commission on the plan outlined by this manual, and officially commended the work of the Occupational Hygiene Division.²¹ Even in the short period between publication of the manual and the close of the war with Japan, it was demonstrated that such a handbook was of utmost importance in complementing general directives regarding the industrial medical program. This brief experience showed that only when policymaking directives were augmented with basic rules and instructions could they be carried out adequately by medical officers and civilian physicians, who often had had little experience with industrial medicine.

The mission of this manual and that of a similar one (Air Technical Service Command Manual No. 25-80-1, "Standard Operating Procedure for Industrial Medical Services in AAF Stations") should be discussed more fully to clarify why there were two such standing operating procedures.

The Occupational Health Division maintained that by use of standard textbooks on industrial medicine and such periodicals as the *American Journal of Public Health* and *Industrial Medicine* physicians and medical officers should be able to handle the problems of general industrial medicine in the field. It made provision for an annual expenditure of \$50 for such books and journals for each industrial dispensary in plants with 5,000 or more employees. Also, a copy of the textbook entitled "Manual of Industrial Hygiene and Medical Service in War Industries" was distributed to each industrial dispensary,²² and publications concerning specific hazardous substances, such as industrial solvents and radioactive luminous compounds, were sponsored by the Surgeon General's Office. It was believed that by this means adequate information on specific disease entities was provided for industrial medical officers and doctors in the field.

This view was not wholeheartedly accepted by some service command surgeons. Therefore, the Eighth Service Command published a manual, "The Toxicology and Prevention of Industrial Diseases," in 1943. This man-

²⁰ WD Form No. 91, "Physical Qualification Placement Record," 22 Mar. 1945; WD AGO Form No. 8-172, "Medical Absentee Record," 1 Mar. 1945; WD AGO Form No. 8-173, "Treatment Record," 1 Mar. 1945; WD AGO Form No. 8-175, "Compiled Daily and Monthly Tally Sheet," 1 Mar. 1945; WD AGO Form No. 8-177, "Quarterly Occupational Health Report," 1 Mar. 1945; and WD AGO Form No. 8-179, "Physical Examination Record," 1 Feb. 1945.

²¹ Letter, Executive Director, and Chief Examiner, U.S. Civil Service Commission, to The Surgeon General, U.S. Army, 20 Apr. 1945.

²² Gafafer, William M. (editor): *Manual of Industrial Hygiene and Medical Service in War Industries*. Prepared by the Division of Industrial Hygiene, National Institute of Health, U.S. Public Health Service. Philadelphia: W. B. Saunders Co., 1943.

ual listed the toxic chemicals, mists, dusts, and fumes which had been encountered in that service command and which were generally met in industrial operations, together with a brief description of the symptoms to be expected in persons poisoned by them, the accepted medical treatment, and the manner in which engineering control of these hazardous substances could be effected. It was prepared from material derived from standard texts on industrial medicine and toxicology. It was also made available to and was used by other service commands.

The two great needs appeared to be (1) a standardization of the manner in which industrial dispensaries were operated and (2) a handbook describing for an assigned officer or physician his responsibilities in the Army industrial medical program. Therefore, the Occupational Health Division prepared for publication Army Service Forces Manual M210, which was limited to the following general subjects: General instructions, industrial hygiene engineering service, relationship to civilian personnel department, preventive medicine program and job assignment, emergency medical or surgical care, employees returning from sick leave, records and reports, industrial dispensary buildings, and industrial dispensary supplies and equipment.

Under the subjects listed were general statements of instruction concerning what was expected of an industrial medical program at an installation, the responsibilities of the physician in charge, and the means whereby he could accomplish his mission.

Shortly after the publication in March 1945 of this manual the Air Technical Service Command, Army Air Forces, issued its own manual. The reason for this special publication was that the Army Air Forces had more direct control over its industrial medical program than The Surgeon General who had to operate through service command and Air Technical Service Command headquarters. This manual, published in August 1945, adopted in general all of the precepts of the manual prepared by the Surgeon General's Office. It added certain specific details, however, which the latter had believed could not be incorporated in an Army Service Forces manual, such as methods of filing information, records, and reports.

The Army Air Forces included in its industrial medical program an active health education program. This proved to be of great value from the standpoint of reduction of lost time due to illness and injury and general reduction in absentee rates.

Army Regulations No. 40-220 (1945).—Although the general principles and concepts of industrial medicine were stated similarly in War Department Circulars Nos. 59 and 198, dated 24 February 1943, and 20 May 1944, respectively, and AR 40-220 entitled "Industrial Medical Program—United States Army," dated 16 October 1945, the last-named directive on the industrial medical program was based on experience gained over 4 years of administrative activity. From some points of view, the

original circulars might well be called a jumble of information, difficult of interpretation, and lacking in the fundamental authority required for adequately establishing and maintaining a program of industrial medicine at the installation level. One reason for the apparent confusion which existed in the two circulars was that the responsibility for Medical Department activities throughout the entire war period was decentralized to lower echelons which were in constant process of change. Since The Surgeon General had no direct channel of authority over the Army Air Forces or the service commands, only recommendations could be made concerning Medical Department activities in the field. Because the Chief of Transportation had fundamentally his own medical service and reported neither to the service command headquarters nor to The Surgeon General, an additional problem was encountered in properly directing the surgeons at ports of embarkation concerning this program.

A War Department circular was a temporary procedure for initiating general orders concerning Army activities, and its term of existence, at the time the war ended, was 18 months. To establish permanently any course of action in the War Department, inclusion of all orders in Army Regulations had to be effected. Thus, AR 40-220 was published in October 1945 as a means of permanently maintaining the industrial medical program in the War Department. Acceptance of this regulation for publication was evidence that the War Department acknowledged the benefits derived from and the need for industrial medicine. This regulation could be considered, therefore, a milestone in the history of preventive medicine in the Army. It was the only Army Regulations on an entirely new subject sponsored by the Preventive Medicine Service. Other regulations written by the Preventive Medicine Service during the war were either modifications of or additions to those already in existence.

This basic regulation was written with the intention of covering generally all principles and policies of the program, of eliminating confusing aspects of the previous circulars, and of affording The Surgeon General sufficient authority to maintain and improve the program. It was worded in such a way as to obviate the need for major changes, even in the event of reorganization of the Army. To this end, authority for administration was delegated to commanding generals having administrative control over Army Medical Department activities for Army-owned and Army-operated industrial plants, arsenals, depots, and ports of embarkation to establish, operate, and supervise the industrial medical service outlined. Paragraph 1 of AR 40-200 could be revised if the industrial medical program were eventually to include all civilian employees of the War Department.

With the publication of AR 40-200 and with the establishment of standing operating procedures for industrial dispensaries, the industrial medical program in the Army for the first time had the fundamentals upon which a more effective program could be built for the following reasons:

1. Authority was established by which The Surgeon General could improve the existing program.

2. Records and reports were received from which data could be compiled for continual critical analysis of the efficiency of this type of medical service.

3. The medical officer in the field had available a handbook and sufficient authority with which to build the kind of service desired and required in this area of preventive medicine.

It was hoped that this regulation would be a firm foundation stone in The Surgeon General's program for civilian employees of the War Department.

Activities of the Toxicology Branch

In the summer and fall of 1943, many new toxicological problems arose. The Quartermaster Corps, the Ordnance Department, the Corps of Engineers, and the Signal Corps had become concerned over serious losses of equipment from mildew in tropical and other humid areas. Fabrics, leather, wood, and electrical devices, as well as other items, were rendered useless. Many items, particularly those of the Quartermaster Corps, were handled a good deal, and it was apparent that mildew-proofing treatments should not render the finished item toxic to military personnel. Investigation of mildew-proofed equipment from the toxicologic standpoint became necessary and request for such investigation began to come to The Surgeon General in increasing numbers, particularly from the Research and Development Branch, Office of The Quartermaster General. It was decided, therefore, to establish a single agency to handle all toxicologic problems within the Surgeon General's Office as they pertained to new items of equipment or supply. Thus, the Toxicology Branch was established on 1 January 1944.

The Toxicology Branch did not, however, take over all toxicologic problems. Certain problems, particularly those related to insecticides, including aerosols, DDT, and methyl bromide, had been handled by other divisions (chiefly Sanitation and Hygiene) of the Preventive Medicine Service and by the United States of America Typhus Commission. All problems previously taken care of by the Army Industrial Hygiene Laboratory and all new problems of toxicity were referred to the Toxicology Branch.

One of the first needs of the Toxicology Branch was an understanding of its own capacities and limitations with respect to its mission, which was potentially large. The limitations were apparent in that only the part-time service of one officer was available for dealing with questions which were often entirely new and which almost always were asked because practical experience was insufficient to answer them. It was possible, however, to utilize the consulting services of such established agencies as the U.S. Public Health Service, the Food and Drug Administration, the Bureau

of Mines, the U.S. Navy's research facilities, the National Research Council, and private laboratories. Problems which could not be solved through the accumulated experience of one or more of these agencies were usually referred to the Army Industrial Hygiene Laboratory for research.

This procedure was successful throughout the life of the Toxicology Branch, but continued efforts were required to keep it running smoothly. Since the Office of The Quartermaster General asked most of the questions for the first year, it was decided that representatives of the Office of The Quartermaster General, the Surgeon General's Office, the U.S. Public Health Service, the Army Industrial Hygiene Laboratory, and the Armored Medical Research Laboratory should meet to discuss common problems with the purpose of improving the service rendered by the Surgeon General's Office wherever possible. A conference was held on 23 and 24 May 1944 at the Armored Medical Research Laboratory²³ and it was agreed that—

1. The procedure followed by the Toxicology Branch was not ideal scientifically because many opinions had to be rendered on the basis of judgment of unknown factors instead of on the basis of scientific data, but it was felt that it was the best that could be done under war conditions when a prompt answer, even if only partly right, was better than a long delayed one.

2. The Army Industrial Hygiene Laboratory was the best agency for making the necessary tests to evaluate the skin-irritating potentialities of fabrics or other proposed items which would be in frequent or intimate contact with the skin of personnel in the field.

3. The Armored Medical Research Laboratory was not particularly well adapted for working on the type of toxicologic problems usually encountered but could work on matters requiring extensive research.

4. Handling of all toxicologic problems would be expedited by having the requesting agency furnish a rather complete statement as to details of manufacture and, in particular, the final use of the item for evaluation.

In June 1944, an officer was assigned to full-time duty in the Toxicology Branch, making it possible for the increasingly complex problems to receive the undivided attention of one person. The main difficulty which he encountered was achieving the necessary day-by-day liaison between the various agencies and individuals involved in any toxicologic investigation. In November 1944, representatives of the Office of The Quartermaster General, the Army Industrial Hygiene Laboratory, the Technical Division of Operations Service, Surgeon General's Office, and the Toxicology Branch, agreed that informal liaison must be maintained at the technical level. In addition, it was decided that requests for toxicity studies and decisions by technical personnel in the Army Industrial Hygiene Laboratory or the

²³ Memorandum, Assistant Director, Occupational Health Division, Surgeon General's Office, for Director, Occupational Health Division, Surgeon General's Office, 27 May 1944, subject: Summary of Meeting on Toxicity Problems Held at Armored Medical Research Laboratory, Fort Knox, Ky.

Office of The Quartermaster General as to continuance or abandonment of projects must be put in writing and cleared through proper channels so that all concerned might be officially informed.

During the first few months of 1945, requests from other services of the Army Service Forces and from the Army Air Forces increased, so that it became clear that better coordination of procedures was necessary. Since the main toxicologic problem at that time was still in connection with tropic-proofed equipment, a meeting was arranged to bring together representatives of most of those military and other governmental agencies concerned with technical decisions on tropic-proofed equipment. This meeting resulted in a clear statement of the policies, responsibilities, and relationships of all participating agencies with respect to toxicity of tropic-proofed equipment in particular and toxicologic problems in general. Minutes of the conference and a bulletin on the toxicity of tropic-proofed equipment were circulated as a result of the meeting.²⁴

Liaison Activities of the Occupational Health Division

The work of the Occupational Health Division was facilitated by its representation on various boards and committees both within and outside the War Department.

War Department Safety Council.—On 31 August 1942, Headquarters, Services of Supply, published Circular No. 55 entitled "Accident Prevention," which charged The Provost Marshal General with preparing general policies and instructions relative to accident prevention at plants and facilities vital to the war effort and at all other Services of Supply establishments, and with supervising accident prevention activities in conjunction with Services of Supply.

Because industrial medical activities and accident prevention are of necessity closely related subjects, the Occupational Health Branch conferred with representatives of the Office of The Provost Marshal General, with a view to coordinating efforts in the overall goal of maintaining, through health and safety, a continuous working force at Army-owned and Army-operated industrial establishments. Informal coordination of activities continued until December when The Provost Marshal General requested that a member of the staff of the Surgeon General's Office be designated to serve on the War Department Safety Council; and the chief of the Occupational Hygiene Branch was so designated.

The first meeting of the Safety Council was held on 30 December, at which time it was stated that the purpose of this group was to coordinate efforts and safety activities for the War and Navy Departments and to promote a better understanding of the general problems, thus allowing op-

²⁴ (1) Minutes, Conference on Toxicity of Tropic-Proofed Materials, Surgeon General's Office, 13 Apr. 1945.
(2) Bulletin, Army Service Forces, Surgeon General's Office, 17 May 1945.

portunities for mutual assistance. The Safety Council, which held monthly meetings, was comprised of representatives of all the technical services of the Services of Supply; Civilian Personnel Division, Services of Supply; Army Air Forces; and the U.S. Navy. The Safety Council continued in operation until August 1945, when activities were suspended.

Representatives of the Occupational Health Division made inspection trips, attended conferences, and assisted in establishing the council's safety program. The cooperative effort of The Provost Marshal General and The Surgeon General in the field of safety for both civilian and military groups of the War Department accomplished much in conserving man-hours during the entire period of World War II.

Advisory Board on Fire and Accident Prevention, Office of the Under Secretary of War.—The activities of the Occupational Health Division during its membership in the War Department Safety Council led to its assistance in the establishment of an accident prevention program for military personnel in the Army.

In January 1944, Colonel Lanza pointed out to the Chief, Preventive Medicine Service, the high admission rate in Army hospitals for nonbattle injuries. He cited the value, which had been proved in industry, of a program of accident prevention and control and recommended such a program for military personnel. He suggested that an accident prevention branch be set up in the Preventive Medicine Service, but this was disapproved on the grounds that accident prevention was not included in the mission of the Surgeon General's Office. The Occupational Health Division, however, assisted in the preparation of a War Department circular (War Department Circular No. 242, 14 June 1944), sponsored by the Surgeon General's Office, directing medical officers in the field to prepare reports, for use by The Provost Marshal General and accident prevention officers, in all cases of accidental injury to military personnel.

On 8 February 1944, the Advisory Board on Fire and Accident Prevention was established in the Office of the Under Secretary of War. The director of the Occupational Health Division was assigned to this board as an additional member to serve on matters pertaining to safety measures. The functions of the board were to review data on important trends in fires and accidents and to make the necessary recommendations when other agencies of the War Department did not take action. As a member of this board, the director was called upon to submit general recommendations concerning accident prevention and to make inspection trips for the purpose of preparing quarterly reports to the Under Secretary. Through its representation on this advisory board, the Occupational Health Division was able to establish more effective relationships with field installations. Shortly after V-J Day, the board was disbanded.

Army-Navy Vision Committee, Office of Scientific Research and Development.—A representative of the Occupational Health Division was ap-

pointed to the Army-Navy Vision Committee, formed in February 1944 for the purpose of coordinating the activities of all branches of the Army and Navy in this field. One of the primary missions of the committee was to transmit to the various governmental agencies information on research in this or other countries concerning eyesight in warfare. At the request of the division, a representative of the Armored Medical Research Laboratory was appointed as a member of the committee in December. This greatly facilitated the laboratory's research with respect to night vision, instrument design, natural illumination, and stereoscopic vision. Later, the Chief, Ophthalmology Branch, Surgical Consultants Division, Surgeon General's Office, replaced the representative of the Occupational Health Division on this committee.

Council on Industrial Health, American Medical Association.—Colonel Lanza, the director of the division, in private life had been a member of the Council on Industrial Health and continued during his Army career to participate actively in the council's work. Thus, as the consultant to The Surgeon General in industrial medicine, he was at all times thoroughly informed of and actively engaged in formulating policies approved by the American Medical Association with respect to industrial medicine in the United States. Access to the meetings of the council were of great assistance to The Surgeon General in setting up the program of industrial medicine in the Army.

Committees of the American Standards Association.—The American Standards Association had as its mission the preparation of standard codes on many matters of interest to industry, both in and out of the Army. Among the committees most active during the war were the Z37 Committee on Toxic Dusts and Gases, the Z53 Committee on a Safety Color Code for the Marking of Physical Hazards, and the Z54 committee on a Safety Code for the Industrial Use of X-rays. An officer of the Occupational Hygiene Branch (later, Occupational Hygiene Division) represented The Surgeon General on each of the Z53 and Z54 committees; in addition, Colonel Lanza, throughout his assignment as chief of the Occupational Hygiene Branch continued to serve on the Z37 Committee, to which he had been appointed in 1938 as a member-at-large. Standard codes were completed during and after the war period and proved of value to the Army industrial medical program.²⁵

²⁵ Allowable concentrations of manganese, Z37.6, approved 16 July 1942; allowable concentration of chromic acid and chromates, Z37.8, approved 6 Jan. 1943; allowable concentration of mercury, A37.8, approved 6 Jan. 1943; allowable concentration of metallic arsenic and arsenic trioxide, A37.9, approved 8 July 1943; allowable concentration of xylene, Z37.10, approved 29 July 1943; allowable concentration of lead and certain of its organic compounds, A37.11, approved 16 Sept. 1943; allowable concentration of toluene, Z37.12, approved 2 Nov. 1943; allowable concentration of oxides of nitrogen, A37.13, 19 Jan. 1944; allowable concentration of methanol, Z37.14, approved 9 Mar. 1944; allowable concentration of styrene monomer, Z37.15, approved 23 Feb. 1944; allowable concentration of formaldehyde, Z37.16, approved 18 May 1944; and safety color code for marking physical hazards and the identification of certain equipment, Z53-1, approved 16 July 1945.

General Public Health Program

Tuberculosis.—A general public health program for the civilian employees of Army-operated industrial installations was inaugurated by a chest X-ray survey begun in 1943 for the purpose of screening out persons with active tuberculosis who were seeking employment in these installations.

Since 1941, the Tuberculosis Control Section, U.S. Public Health Service, had been organizing a group of survey teams equipped with 35 mm. X-ray photofluorographic units and was in the process of making a nationwide tuberculosis survey. This service of chest X-ray surveys was offered to certain Army-operated industrial plants by the Tuberculosis Control Section, U.S. Public Health Service.

At a conference of the Chief, Occupational Hygiene Branch, Surgeon General's Office, with the Deputy Surgeon General, U.S. Public Health Service, and the Chief, Division of Industrial Hygiene, U.S. Public Health Service, in March 1943, it was agreed that such surveys were advisable and that the U.S. Public Health Service should conduct tuberculosis case-finding surveys among the employees of Army-owned and Army-operated industrial plants without cost to the Surgeon General's Office.

Little difficulty was encountered in carrying out this chest X-ray survey program. Not all of the installations were surveyed because of certain commitments of the U.S. Public Health Service and because some of the larger Army-owned and Army-operated plants were already supplied with 4- by 5-inch photofluorographic X-ray machines and could make their own surveys. It was intended that X-ray examination of the chest would be performed routinely on all employees hired after the original survey. However, this was not feasible in certain small installations which did not have an X-ray machine.

The accomplishments of this chest X-ray survey were as follows: Of 328,924 X-rays taken, 3,674 cases of active tuberculosis and approximately 1,100 suspected cases were discovered. In its public health aspects, this tuberculosis survey was most important in maintaining the general health of the Army's civilian industrial population. Not only were all persons with active tuberculosis relieved from duty and put under medical care (the U.S. Public Health Service made such arrangements) but such a case-finding survey served to stimulate industrial medical officers to maintain a pre-placement check on employees hired subsequent to the survey.

Venereal disease.—The question of whether to instigate a general venereal disease control program among employees in Army industrial plants was discussed at great length with the medical officers in both the service commands and the Army Air Forces, in addition to those concerned in the venereal disease control program of the U.S. Public Health Service. Certain large Army Air Forces installations at which there were sizeable

military hospitals did establish such a program and offered treatment to all those with positive serologic reactions. As a general rule, however, the Surgeon General's Office adopted the policy of performing routine serologic examinations only on those employees who were being hired for work of a type which might have jeopardized their health had they been infected with syphilis or been undergoing antisyphilitic treatment. In other words, persons to be employed on TNT lines or in the manufacture of high explosives, incendiaries, chemical warfare products, or other agents which might cause systemic disease, particularly of the liver, were given routine serologic tests and not assigned to such work if they showed a positive reaction.

Preplacement physical examination.—A general policy regarding the performance of preplacement physical examination was established as a result of questions posed by industrial medical officers at Army installations and by service command surgeons. This policy, which was considered a necessary adjunct to existing regulations, was promulgated in War Department Circular No. 105, "Army Industrial Medical Program," dated 13 March 1944, section III. It provided that preplacement physical examinations should be made on all employees of installations falling within the scope of War Department Circular No. 59. Only those applicants were barred from employment whose physical condition was such that it endangered the employee, his fellows, or the plant itself. Smallpox vaccination for all employees was encouraged. Instances were cited wherein serologic examination for syphilis and X-ray examination of the chest were required as part of this examination.

Women employees.—It was thought that policy on women employees, especially with respect to pregnant employees, should also be definitely stated. In many Army industrial plants, the percentage of women employees had risen from a low figure at the beginning of the war to between 40 and 70 percent by 1944. Also their job assignments, formerly predominantly clerical, had been expanded to include practically every type of work. Many types of employment to which women were assigned presented a hazard either to the pregnant employee or to the continuance of the pregnancy. Action frequently taken by personnel departments to avoid such contingencies was dismissal of employees who became pregnant. In reapplying for a job following termination of the pregnancy, such a woman found she had lost her employment seniority.

As it was to the advantage of the Government to rehire such trained personnel and to keep them on the job, even though pregnant, as long as was considered safe, the Women's Bureau of the Department of Labor, the American Medical Association, and recognized obstetricians and gynecologists were consulted in the matter. On information received, a policy was formulated and published as War Department Circular No. 288, dated 10 July 1944. This circular was widely acclaimed as the first of its kind in

American industry. In brief, it limited the work period, in relation to both weeks of pregnancy and post partum period, and the work shift. It required that the job assignment not endanger the employee and that her seniority privileges not be lost by virtue of her pregnancy. This policy was well received by commanding officers of industrial installations, who considered it a definite advance in employment relations between the War Department and its civilian personnel.

Vaccination.—Little difficulty was encountered by field agencies in carrying out the two directives previously mentioned. Another problem, however, which was raised in certain plants was the smallpox vaccination which some commanders made mandatory for all employees who had not been vaccinated within 5 years of the time of job application. Others demanded typhoid vaccination for their employees. Army Regulations already provided a commanding officer with authority to order vaccination of all persons residing or working on his post or to restrain them from entering the military reservation in the event of an epidemic or threat of an epidemic. Generally, it was the policy of The Surgeon General not to demand such public health measures unless they were actually needed to insure the health and maintain the working efficiency of War Department employees.

CONTROL OF OCCUPATIONAL DISEASE IN EXPLOSIVES PLANTS²⁶

Industrial Hygiene Branch, Office of the Chief of Ordnance

Soon after the organization of the Occupational Health Section, conferences were held with the Office of the Chief of Ordnance relative to industrial medical service in the industrial plants controlled by that office.

It was recognized at the outset that the nature of ordnance plants, their size and number, make imperative not only an exceedingly effective accident and explosion preventive program but also an energetic program to control occupational diseases. Accordingly, in July 1942, Lt. Col. (later Col.) William J. McConnell, MC, an officer of the Occupational Health Section was attached to the Safety and Security Division of the Chicago, Ill., office of the Chief of Ordnance, and two commissioned officers of the U.S. Public Health Service were detailed by that service to assist him; these three constituted the Industrial Hygiene Branch.

Thus, there was set up, under the joint supervision of the Office of the Chief of Ordnance and the Surgeon General's Office, what proved to be a most efficient industrial medical office.

Included in this program were plants manufacturing, processing, and loading explosives, as well as arsenals and depots handling ordnance material. Some plants were Army owned and operated by the Ordnance De-

²⁶ McConnell, W. J., Flinn, Robert H., and Brandt, Allen D.: *Occupational Diseases in Government-Owned Ordnance Explosives Plants: Observations on Their Prevalence and Control During World War II*. *Occup. Med.* 1: 551-618, June 1946.

partment; others were Army owned and operated by contractors; others were contractor owned and operated. All were a responsibility of the Office of the Chief of Ordnance especially with respect to accident and catastrophe prevention and prevention of occupational diseases.

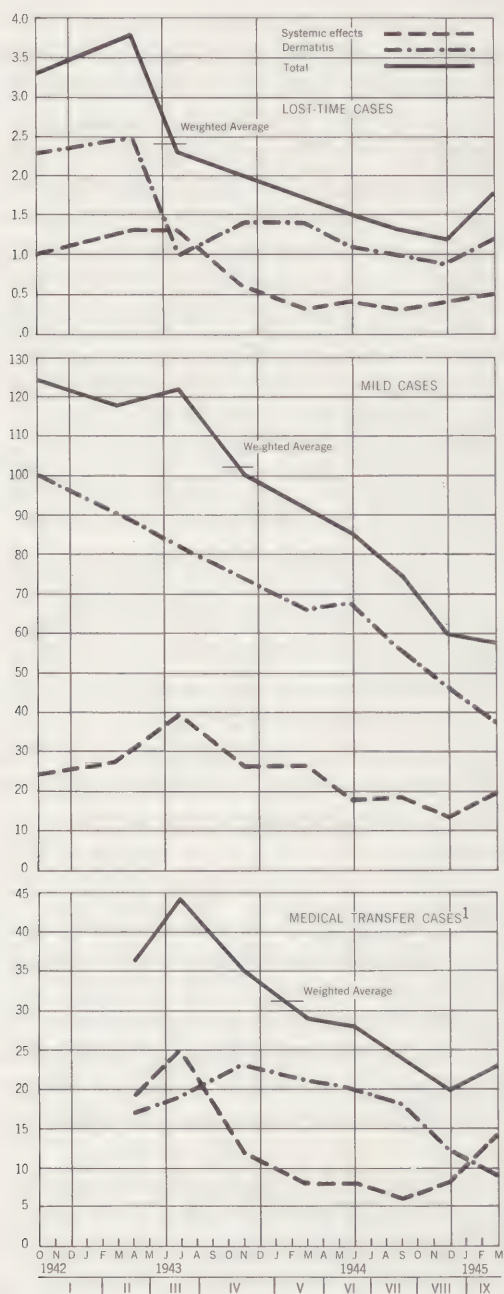
A statistical analysis and record of the experience, from a medical standpoint, of the Industrial Hygiene Branch, Safety and Security Division, Office of the Chief of Ordnance, shows some results of the Army industrial medical program (chart 3). The records upon which is based the industrial illness experience of the ordnance establishments recorded here were obtained by order of the Chief of Ordnance. Similar records were not maintained for the overall program because authority for establishing an adequate reporting system from all installations was not received by The Surgeon General until 1945 when AR 40-220 and Army Service Forces Manual M210 were published. Since The Surgeon General had no authority to issue such an order for all plants, he could merely inspect for adequacy the programs as administered by commanding generals.

Among the general activities by which the Industrial Hygiene Branch, Office of the Chief of Ordnance, accomplished its mission were the industrial hygiene engineering surveys conducted in the contractor-owned, contractor-operated plants and Government-owned, contractor-operated plants by the U.S. Public Health Service, and surveys done in the Government-owned, Government-operated plants by the Army Industrial Hygiene Laboratory. Such surveys were requested and made about every 6 months in plants presenting more serious health hazards, and about once yearly in other plants. The staff of the Industrial Hygiene Branch made the necessary followup visits to insure compliance with all recommendations. Special studies were made by this office in all plants from time to time as new problems developed, and technical consulting services were made available on all health problems.

Cooperating agencies.—The Industrial Hygiene Branch several times requested assistance from agencies of the U.S. Public Health Service to utilize their specialized knowledge of certain problems. The Industrial Hygiene Research Laboratory of the National Institute of Health conducted extensive laboratory and field research on the toxicology of explosives, such as TNT, PETN (pentaerythritoltetranitrate), a special type of explosive known as RDX (cyclonite), and certain new aromatic gasoline additives, and the laboratory provided bulletins on these subjects,²⁷ and also a review

²⁷ (1) Von Oettingen, W. F., Donahue, D. D., Snyder, R. K., Rorecker, B. L., Monaco, A. R., Lawton, A. H., Sweeney, T. R., and Neal, P. A.: Experimental Studies on the Toxicity and Potential Dangers of Trinitrotoluene (TNT). Pub. Health Bull. No. 285, Federal Security Agency, U.S. Public Health Service, 1944. (2) Von Oettingen, W. F., Donahue, D. D., Lawton, A. H., Monaco, A. R., Yagoda, H., and Valaer, P. J.: Toxicity and Potential Dangers of Penta-Erythritol-Tetranitrate (PETN). Pub. Health Bull. No. 282, Federal Security Agency, U.S. Public Health Service, 1944. (3) Sievers, R. F., Lawton, A. H., Skoog, F., Stump, R. L., Monaco, A. R., Neal, P. A., and Von Oettingen, W. F.: A Medical Study of the Effect of TNT on Workers in a Bomb and Shell Loading Plant: Report of a Fatal Case of Aplastic Anemia. Pub. Health Bull. No. 291, Federal Security Agency, U.S. Public Health Service, 1945.

CHART 3.—Occupational disease experience in all assigned Government-owned ordnance plants, by report periods, 1942-45
[Rate per 1,000 man years of operations]



1. Medical transfer cases not reported for first period.

Source: McConnell, W. J., Flinn, Robert H., and Brandt, Allen D.: Occupational Diseases in Government-Owned Ordnance Explosives Plants: Observations on Their Prevalence and Control During World War II. *Occup. Med.* 1:551-618, June 1946.

of literature on the toxicity of aromatic amino and nitro compounds, which included most explosives.²⁸ The Dermatoses Investigations Section, Division of Industrial Hygiene, National Institutes of Health, U.S. Public Health Service, provided consultation on occupational dermatoses and made field investigations concerning control of tetryl dermatitis and the possible value of protective ointments.²⁹ The Water and Sanitation Investigations Station, U.S. Public Health Service, on request, made several field studies of the possible excessive stream pollution from the by-products of plants manufacturing and loading explosives, and its reports were distributed to all plants concerned.³⁰

Publications.—The Publications Branch of the Safety and Security Division, Office of the Chief of Ordnance, prepared and distributed more than 60 industrial hygiene information circulars to ordnance plants to meet specific problems. These included circulars on the prevention of TNT poisoning; control of tetryl dermatitis; special indicator soaps for TNT, tetryl, and mercury fulminate; local exhaust ventilating systems for explosive dusts; diagnosis of syphilis; health hazards in maintenance shops; nutrition in industry; nitrogen oxide poisoning; early diagnosis of tuberculosis; safe handling of milk; use of handicapped workers; cooperation of plant and private physicians; influenza; sick absentee control; dust control; respirators; disinfection of shoes; TNT waste disposal; medical certificates; treatment of toxic jaundice; and epidemic keratoconjunctivitis. Several circulars were prepared on hazards from solvents and means for their control.³¹ In addition, an industrial safety and hygiene manual which contained minimum standard policies and procedures was prepared and distributed.³²

Educational program.—Several meetings were organized by the Safety and Security Division with the medical directors of the various plants in order to collect recent information on troublesome subjects, such as nitrogen oxide poisoning and TNT poisoning. Representatives of the Surgeon General's Office, the U.S. Public Health Service, the Bureau of Mines, and other national agencies participated in the conferences. The transactions of these meetings, containing recommended policies for controlling occupational diseases, were distributed to all plants.

Classes were held repeatedly on industrial hygiene subjects for the safety auditors in the Inspection Branch of the Safety and Security Division. As these inspectors made quarterly visits to all plants, they provided

²⁸ Von Oettingen, W. F.: *The Aromatic Amino and Nitro Compounds: Their Toxicity and Potential Dangers*. Pub. Health Bull. No. 271, Federal Security Agency, U.S. Public Health Service, 1941.

²⁹ Schwartz, L.: *Dermatitis From Explosives*. J.A.M.A. 125: 186-190, 20 May 1944.

³⁰ Smith, R. S., and Walker, W. W.: *Surveys of Liquid Wastes From Munitions Manufacturing*. Pub. Health Rep. 58: 1365-1379, 10 Sept. 1943.

³¹ (1) Circular Letters, Safety and Security Division, Office of the Chief of Ordnance, 1942-45. (2) Industrial Hygiene Information Circulars, Safety and Security Division, Office of the Chief of Ordnance, 1942-45.

³² *Industrial Safety and Hygiene Manual*. Safety and Security Division, Office of the Chief of Ordnance, 27 Sept. 1943 (ch. I), and 1 July 1944 (ch. II).

the Industrial Hygiene Branch with a valuable source of information on new or changing health hazards. Numerous recommendations regarding sanitation and the control of health hazards, as well as the various subjects included in safety and security audits, resulted from their inspections.

Considerable resistance was at first encountered from loading plants operators to controlling the more dusty TNT operations, such as screening, by local exhaust ventilation because of the explosion hazard associated with ductwork and fans. This apprehension was gradually overcome in all quarters after individual wet collector systems were developed which proved to be reasonably safe and efficient.

Proper control of bathing and change of clothing among TNT workers was a troublesome problem in many plants, although the old, experienced chemical companies that started operations with a rigid program had little difficulty. Accordingly, a continuous campaign of instructing supervisory personnel and employees as to the reasons and need for a vigorous bathing program had to be carried out with slow but generally satisfactory results. The high labor turnover in these plants aggravated this and related problems.

The plant medical facilities and services were uniformly good and were improved for the most part as the program was developed. Close medical supervision of workers exposed to toxic substances resulted in the detection and transfer of many in the early stages of occupational diseases before they could become serious and pointed out the necessity for further engineering control.

The results of this comprehensive and closely integrated health and hygiene program in ordnance explosives plants is shown in the succeeding analysis and discussion. The amazingly good safety record achieved by the Safety and Security Division in ordnance plants closely parallels the health record. It was a matter of pride to the Medical and Ordnance Departments that for fiscal year 1945, during peak production, the lost-time accident frequency rate in all Government-owned explosives plants was among the lowest for all American industries. This rate included, of course, lost-time occupational diseases.

In the annual report of the Chief of Ordnance for the fiscal year ending 30 June 1945, the following statements appear:

Although the accident rate for Government-owned Ordnance installations had touched the remarkable low of 5.6 per million man-hours worked in July 1944, the rate improved constantly, and by May 1945 had dropped to 4 million man-hours, a 28.6 percent reduction. The combined rate for Government-owned and privately-operated Ordnance establishments made an even greater decline—32.8 percent below the July 1944 rate. This not only represents an all-time low for the Ordnance Department, but is also the lowest for all American manufacturing industries * * *.

During World War I, the [United States] facilities which produced 40 percent of the military explosives used by the Allies reported a ratio of 230 fatalities per billion pounds of explosives manufactured. In this war, the Government-owned, contractor-

operated plants producing 95 percent of all [United States manufactured] military explosives have suffered only 5 fatalities per billion pounds of explosives produced.

Description of Ordnance Explosives Establishments

The Government-owned ordnance plants making, processing, handling, or storing explosives assigned to the Safety and Security Division for production security inspections fell into nine distinct types of industries. From the industrial hygiene and many other points of view, no one industry could be fairly compared with another because of the wide divergence of functions and operations. Six of the industries included the war-built explosives manufacturing or loading plants operated by contractors from private industry. The other three groups included the Army-operated arsenals, depots, and proving grounds. Since more than 95 percent of all explosives and large caliber ammunition made in the United States during World War II, as well as 90 percent of the small arms ammunition, was produced and loaded in the new contractor-operated facilities, these naturally were of paramount importance in the industrial hygiene program.

Bomb, shell, and fuse loading plants.—From 17 to 20 contractor-operated plants were engaged in loading high explosives, such as TNT, amatol, pentolite, tetryl, and TNT and RDX compounds into bombs, shells, mines, grenades, and rockets. These plants usually had additional lines where fuses were loaded with detonating agents, such as lead oxide and mercury fulminate, and with booster charges, such as tetryl. Where complete rounds of ammunition were assembled, smokeless powder was used extensively, and double-base powder containing nitroglycerine was used commonly for mortar shell increments and for propelling charges for rockets. Black powder and percussion elements containing sensitive explosives were used on lines manufacturing artillery primers. This industrial group, like all others, had sufficient maintenance shops to care for all equipment, buildings, and vehicles.

The number of employees in these loading plants actually engaged in manufacturing operations varied between 65,000 and 91,000, the average figure being 78,000 for the period considered here. The annual labor turnover was close to 100 percent.

Because of the nature of loading operations, more employees were exposed by the open handling of dusty or fuming compounds, and the toxic exposures were normally greater than in the other industrial groups.³³ Consequently, more supervisory attention and control measures for toxic exposures were required by loading plants than by any other group.

In addition, many of these loading plants were operated for the Ordnance Department by concerns which had had but little previous experience

³³ (1) Seifert, H. E., Cralley, L. J., and Clayton, G. D.: Industrial Health Hazards and Their Control in a Bomb Loading Plant. *Indust. Med.* 14: 75-80, January 1945. (2) Brandt, A. D.: Industrial Hygiene Engineering in the Army Explosives Manufacturing and Processing Industry. *Indust. Med.* 13: 639-648, August 1944.

in handling toxic chemicals. These included companies previously engaged in heavy construction work, consulting engineering, and the manufacture of soap, rubber products, typewriters, hospital supplies, paints, radios, cereal foods, and roofing and building materials. Only one of these primary contractors had had peacetime experience in handling military explosives.

These two factors placed the operating contractors at an initial disadvantage from a health and safety viewpoint and made their occupational disease and accident record all the more remarkable.

High explosives manufacturing works.—From 11 to 15 contractor-operated works were engaged in manufacturing TNT, DNT (dinitrotoluene), tetryl, PETN, pentolite, RDX, and lead oxide. TNT was the product common to all these plants. In addition, they all manufactured nitric acid from anhydrous ammonia for their own use, and many produced sulfuric acid from sulfur. Three of these works also produced large quantities of single-base or double-base smokeless powder and so might be classified as powder plants. They are here considered as TNT plants, however, because that was the principal health hazard involved.

As many of these industrial chemical processes were enclosed and relatively few employees were needed for production operations, the problem of health hazards was much less serious than in the loading plants. The average number of employees engaged in production was 36,400 and ranged from 25,000 to 45,000. The annual labor turnover was 65 percent.

Unlike the loading plants, most of these explosives works were operated by corporations with long experience in making and handling explosives. The remaining contractors had had considerable experience in the field of chemistry and were well prepared to recognize the potential dangers of handling toxic explosives.

Smokeless powder works.—Four or five contractor-operated works, in addition to those mentioned previously, were engaged in the manufacture of smokeless powder and employed an average of 19,400 workers, in production, the numbers ranging from 14,000 to 29,000. The annual labor turnover was 83 percent. The smokeless powder works were all operated by old powder companies which were well acquainted with the health hazards involved.

Acids, nitrocellulose, diphenylamine, and nitroglycerine were manufactured as ingredients for smokeless powder. One of the plants employed relatively few workers in the manufacture of TNT and tetryl, and another, in the manufacture of dimethylaniline. Ether-alcohol and DNT exposures were the principal health hazards in the manufacture of single-base powder, while exposure to nitroglycerine was the chief hazard with double-base powder. The oxides of nitrogen offered a potentially serious hazard in the manufacture of nitric acid and in nitrating cellulose.

Miscellaneous chemical works.—Nine or ten contractor-operated works were engaged in the manufacture of basic chemicals for explosives. They

employed an average of 4,400 workers, the number ranging from 3,500 to 5,700, with an annual labor turnover of 25 percent. Six of these plants manufactured anhydrous ammonia, and the other produced ammonium picrate, ammonium nitrate, ammonia, picric acid, hexamine, formaldehyde, and methanol. These works were operated by chemical companies which had had considerable experience with this type of operation. The processes were largely enclosed and required relatively few workers.

Small arms ammunition plants.—From four to 12 contractor-operated plants were engaged in the manufacture of .30, .45, and .50 caliber ammunition, the number of plants being drastically reduced during the last year of war. On the average, 85,000 employees were engaged in production operations, the number varying between 31,000 and 167,000. These plants made about 90 percent of the small arms ammunition produced in the United States during World War II. The annual labor turnover was approximately 30 percent, which is lower than that for most other industries discussed here because the plants were located in or near large centers of population, where housing and transportation were not the problems they were for the plants in rural areas.

Relatively few employees were exposed to toxic chemicals in this industry, and these were largely in segregated bays or workrooms where tracer, igniter, or incendiary powders were pressed into hollow bullet cores. Many workers attended case and bullet draw machines which offered exposures to cutting oils and coolants. Also, large numbers of workers were engaged in soldering operations and in occupations involving solvents. The exposures to lead in the manufacture of bullets and in proof-firing were generally well controlled, as were those in mercury-crack testing.

The peacetime background of the contractors operating these plants was mostly in the same industry, although several plants were operated by rubber companies and one by an automobile manufacturer.

Bag-loading plants.—From two to four plants employing from 4,600 to 13,700 workers in production, with an average of 9,100, were engaged in making textile bags and in loading the bags with specified amounts of smokeless powder for fixed and semifixed artillery ammunition. The chief exposures were to black powder and to finished smokeless powder which contained small amounts of DNT. There were also the usual maintenance shops which offered the ordinary exposures to solvents and gases. No serious health hazard was encountered in these plants.

The bag-loading plants were operated by a powder company, a rubber company, and a producer of soft beverages. The annual labor turnover was 112 percent.

Arsenals.—The Army-operated arsenals handling explosives were essentially peacetime developers and producers of military ammunition and firearms, and they also renovated or modified obsolete or defective ammunition and equipment. A few had operated relatively small pilot lines

for the experimental manufacture of explosives and for shell loading. When full-scale production was achieved in the new ammunition plants, these loading operations, however, were largely converted to other activities except for the loading of bursters for the Chemical Warfare Service.

During this war, an average of 53,000 employees was engaged in production in the 10 to 12 arsenals handling explosives, the number ranging from 40,200 to 64,700. Data as to the annual rate of labor turnover were not available, but it was known to have been rather high. Activities included the manufacture of tetryl, smokeless powder, pyrotechnics, small arms ammunition, artillery cartridge cases, artillery projectiles, time fuses, fire control instruments, small arms, and target material. In addition a few of the arsenals were engaged in the loading of chemical and high explosive artillery and mortar shells. Several arsenals were occupied chiefly in the storage, maintenance, and issue of ordnance materiel. Others had extensive facilities for repairing, modifying, and renovating materiel, such as tanks, artillery, and optical equipment. Those arsenals which did not handle explosives are not included in this analysis.

So far as the handling of explosives was concerned, the activities of the manufacturing arsenals provided a limited cross section of activities in the new ammunition plants. The number and degree of toxic exposures varied considerably from one arsenal to another.

Depots.—From 13 to 18 ordnance depots were engaged in the receiving, storing, and issuing of ammunition and explosives. An average of 24,800 employees was engaged in depot operations, the number ranging from 21,600 to 29,400. The annual labor turnover was not known but was believed to have been fairly high.

In general, the older depots only received, stored, and issued explosives and ammunition, and performed necessary renovation and modification of defective or obsolete ammunition. Limited loading of TNT was done for short periods in two of these depots, but the total number of exposed workers did not exceed 300. One of the depots which continuously loaded a number of explosives was included with the manufacturing arsenals.

The newly built depots received, stored, and issued general supplies, in addition to ammunition and explosives. There were also extensive tank repair and modification operations. In several of the depots, large numbers of employees were engaged in the repair and modification of artillery and optical equipment.

It is evident that occupational exposure to toxic explosives was not a major problem in the depots. On the other hand, the extensive repair and modifying operations on ordnance materiel meant that many workers were exposed to potentially hazardous concentrations of solvents, paints, cutting oils, and related chemicals.

Proving grounds.—Six proving grounds, including one small ballistics laboratory, employed an average of 7,200 workers in operations, the number varying from 4,600 to 13,700. Their activities included the proof-

ing of developed types of ammunition and research on new types, modification of artillery, and the proof-testing and acceptance-testing of all types of weapons, including bombs and mines.

While only 20 to 25 workers were regularly exposed to TNT, many and varied exposures were resulting from proof-firing of ammunition, including those to carbon monoxide, lead, nitroglycerine, and the nitrogen oxides, and from the cleaning, degreasing, and painting of ordnance materiel, including those to solvents, paints, and cutting oils.

Occupational Disease Reports and Methods of Analysis

Shortly after the Industrial Hygiene Branch, Office of the Chief of Ordnance, began to function, a plan was devised for obtaining complete occupational disease reports on a quarterly basis from all Government-owned explosives plants from the beginning of World War II production. The Safety and Security Division, Office of the Chief of Ordnance, was already receiving accident reports from these plants which presumably included fatalities and lost-time illness from occupational disease, as these were somewhat difficult to separate from the accidental injuries. Also, the accident injury reports did not uniformly include the mild, nondisabling cases of occupational disease, or the medical transfers of persons away from exposures to toxic substances because of early signs and symptoms of occupational diseases. In some instances the plant safety personnel who prepared the accident statistics did not have ready access to all the medical data desired for complete occupational disease reporting.

Accordingly, a form was developed by this branch for obtaining from the medical department of each plant complete occupational disease reports which would be processed and checked by the plant's commanding officer and his staff, representing the Ordnance Department.³⁴ This form was sent to the commanding officer of each plant with the request that each medical department complete the form, supplying all data from the beginning of World War II production but not before 1 June 1941, in plants that had been operating during peacetime. In most plants, this meant from the beginning of war production, and in the old arsenals it approximated the beginning of expanded national defense activities. The inclusive dates covered by each report period are listed as follows:

<i>Report period</i>	<i>Date</i>
1.....	1 June 1941–February 1943
2.....	March–May 1943
3.....	June–August 1943
4.....	September 1943–January 1944
5.....	February–April 1944
6.....	May–July 1944

³⁴ Occupational Disease Report (C.D. Reg. No. 07-394-GU-OC), Safety and Security Division, Office of the Chief of Ordnance.

<i>Report period</i>	<i>Date</i>
7	August–October 1944
8	November 1944–January 1945
9	February–April 1945
10	May–July 1945

Each report included the average number of employees for the period who were actually engaged in production or operating activities, the average number actually exposed to TNT, and the number of cases of general or systemic poisoning and dermatitis resulting from exposure to TNT, tetryl, nitrogen oxides, solvents, cutting oils, and other specified toxic substances. These cases were further classified as fatalities, lost-time or disability cases, mild or nondisability cases, and medical transfer cases included those workers who presented some signs or symptoms suggesting an excessive exposure to toxic substances and who were changed to another job on recommendation of the Medical Department as a protective measure. These cases also may or may not have been included in the disabled or mildly affected group but were of importance in themselves because of the production factors and economics involved and as an additional index of the adequacy of other medical and engineering control measures.

The reports for the first period (through February 1943) covered production periods ranging all the way from 1 to 21 months, the weighted average being 8.6 months, taking into consideration the varying numbers of employees in each plant. In fact, some plants were not yet in active production during the first period.

After the first period, the reports were sent out for completion at quarterly intervals, excepting one period, the fourth, when administrative difficulties delayed the reporting procedure for 2 months. The number of plants varied slightly from time to time, as some were inactivated or new ones were opened. Because of the primary mission of the Safety and Security Division, however, the list always included all Government-owned ordnance plants handling explosives but did not include other ordnance plants handling only "inert," or nonexplosive, materiel.

In cases of serious illness from exposure to toxic substances, the Industrial Hygiene Branch was immediately informed, frequently by telephone, by either the commanding officer or the medical director. In many instances, advice was given regarding treatment or a medical officer of the Industrial Hygiene Branch visited the patient.

Case rates on TNT poisoning, the most important occupational disease, were based on the actual number of employees exposed to TNT, a procedure which gave the true relationship of those affected to those exposed. Because it was not possible to obtain the exact data as to the number of employees exposed to all the other chemical compounds in these plants, occupational disease rates for other products were based on all employees engaged in production, that is, on all those employees potentially exposed, but excluding those not exposed by reason of working in such areas as the administration

buildings. The ratio of total employees to those engaged in production varied from 140 to 170 percent in the various industrial groups.

Because of the long first period and the 5 months in the fourth period, it was not possible to calculate case rates for occupational disease as percentage, or per 1,000 or 10,000. Also, the accepted practice of safety auditors in reporting so many disabling injuries per million man-hours of work meant little to medical men and others in the industrial hygiene field, as this concept was difficult to visualize by those not engaged in accident reporting. Accordingly, the occupational disease rates were shown per 1,000 man-years of production, or in the case of TNT poisoning, per 1,000 man-years of actual exposure. This report was equivalent to the potential exposure of 1,000 men for 1 year, or 4,000 men for 1 quarterly period, and equalized the irregularity of duration of the report periods. Data for 1,000 man-years of production could be easily converted to those for 1 million man-hours of work by dividing the former figures by 2.4 (1,000 man-years being roughly equivalent to 2.4 million man-hours). Wherever lost-time cases were discussed, the rates were shown by both methods for the convenience of safety personnel.

The lost-time disabilities were the cases serious from the medical viewpoint and indicated that employees were sufficiently ill to lose one daily shift or more from work. Data were not available as to the average duration of lost-time disabilities, but it was known that they ranged all the way from 1 day to 1 month or longer.

The nondisabling or mild cases were usually of little medical significance. When a disease was systemic, it often was manifested only in minor symptoms at the first aid station or slight changes in laboratory findings during periodic examinations. The mild dermatitis cases in this group readily cleared up under treatment and caused no real disability.

The medical transfer cases were drawn largely from the two previous groups and represented those employees sufficiently affected by exposure to toxic substances to make a change of work advisable. In most plants when the indication was not definite, the Medical Department gave the patients the benefit of the doubt and removed them temporarily for their protection. Occasionally, workers were found to be hypersensitive to certain substances and were transferred permanently. The proportion of permanent to temporary transfers is not known.

The medical transfers were of particular importance from the viewpoint of efficient production, as even the temporary loss of trained personnel from any job necessarily retarded production. The marked decrease in the transfer rates shown during the period undoubtedly more than offset any costs incident to better industrial hygiene control measures. All cases of medical transfer were potential cases of serious disability or even death had the exposure to toxic substances been continued.

TNT (Trinitrotoluene)

Exposure

Bomb and shell loading plants.—The primary objectives of the industrial hygiene surveys conducted in the ordnance plants included evaluation of the workers' exposures to toxic materials, and advice on satisfactory control measures where excessive exposures were found to exist.

Much of the early reduction in atmospheric TNT contamination in loading plants was accomplished chiefly by means of better housekeeping, more careful performance of operations, enclosure of dust sources, and isolation of dusty operations, and very little by improved ventilation. Considerable improvement of working conditions by means of general and local ventilation was effected in the latter part of the war, but even then adequate ventilating systems were not installed wherever they were needed because they frequently introduced an important fire and explosion hazard which was not easy to overcome and because their installation sometimes involved considerable expense which would not be justified for temporary industries, and furthermore, the operations and their nature were changed so often to keep abreast of the requirements at the fighting fronts that permanent ventilating systems were often obsolete shortly after installation. Better atmospheric sanitation could have been obtained if more extensive use of ventilation systems had been possible. Substantial reduction in atmospheric TNT contamination was accomplished at very dusty operations, while less reduction was achieved at those operations which presented a less serious hazard.

There was a rapid drop from the first to the second 6-month period in 1944, even though the curve for the amount of TNT loaded rose rapidly. This was undoubtedly brought about by the more common use of proper ventilating measures near the end of the war. Also of interest is that the weighted average atmospheric TNT concentration exceeded the maximum allowable concentration of 1.5 mg. per m.³ for all periods except the last period in 1944. Even during this period, however, some of the workers were exposed to atmospheric TNT concentrations well above 1.5 mg. per cubic meter.

Sufficient specific data to substantiate or disqualify the value of 1.5 mg. per m.³ as the maximum allowable concentration were not available. This value was recommended by the U.S. Public Health Service early in 1941 on the basis of data obtained from British and Canadian workers in industrial hygiene.³⁵ The overall results seem to indicate that a somewhat lower value in the order of 1 mg. per m.³ is preferable and can be attained with no great difficulty in plants where proper engineering control is exercised. It seems unlikely, however, that even 1 mg. per m.³ will prevent all fatalities, since of the 22 deaths in World War II attributable to TNT

³⁵ See footnote 22, p. 134.

poisoning, one-third occurred in workers employed at operations producing average atmospheric TNT concentrations of 1 mg. per m.³ or less.³⁶ As with other toxic materials, it appears that a few persons are extremely hypersensitive to TNT. Since it is absorbed also through the skin and gastrointestinal tract, it may be that unusually poor personal hygiene played an important part in the total amount of TNT absorbed by the workers who died, even though the atmospheric contamination to which they were exposed was low.

Manufacturing plants.—The severity of exposure to atmospheric TNT in manufacturing plants was mild compared with that in the loading plants, and the number of workers exposed were also much less. The trend of the atmospheric TNT concentrations was the same as that for the loading plants.

Local exhaust ventilation was used much more commonly in the manufacturing plants than in the loading plants, even from the beginning of operation. All operations in the manufacturing works which caused considerable atmospheric contamination were provided with local exhaust ventilation. Some of these systems were unsatisfactory at first, but all in all, they were very successful in preventing what otherwise would have been severe exposures.

Poisoning

BOMB AND SHELL LOADING PLANTS

Exposure of employees to TNT in the bomb and shell loading plants was quite limited for some months after the beginning of operations in 1941 because of the necessity for eliminating hazards in mass production, the care used in building up safe and efficient practices among employees, and the difficulty in procuring the steady supply of necessary components. The effects of exposure to TNT are cumulative and often take some time in building up to the point of overcoming an employee's resistance. Consequently, the average peaks of initial exposure were not reflected in the curves for TNT poisoning until in the spring and summer of 1943. The rate for all systemic TNT illness was relatively low during the first 9 months of all plants and increased rapidly as production and exposure increased during March and April 1943. Then, until the war ended, the converging effects of the medical and engineering control programs become apparent, as shown by a sharp drop in rates to a low level for disabling and nondisabling poisoning, medical transfers, and fatalities, despite the sharp rise in production.

Fatalities due to TNT.—There were 18 fatalities among an average monthly population of about 16,800 TNT-exposed employees in 34.8 months of operation, so that the overall death rate among TNT-exposed employees

³⁶ McConnell, W. J., and Flinn, R. H.: Summary of Twenty-two Trinitrotoluene Fatalities in World War II. *J. Indust. Hyg. and Toxicol.* 28: 76-86, May 1946.

was less than 0.4 per 1,000 man-years of exposure. This was considered an excellent overall record, as compared with the last war when 475 deaths were reported in 7½ months among workers handling TNT and related compounds. It was believed that the number of employees exposed to TNT were considerably less in the United States during the war years of 1914–18 than during World War II. Also, the high rate of labor turnover during the latter war, which approximated 100 percent annually, meant that many more employees were exposed to TNT than the average figure of 16,800 suggests.

The effects of the industrial hygiene control program were all the more apparent when it was noted that there were only four deaths in the last 15 months, as compared with 11 deaths in the preceding 11 months.

Lost-time cases.—The record for lost-time cases of TNT poisoning and dermatitis was of particular interest for comparison with standard frequency rates for lost-time accidents. There were 340 lost-time cases of poisoning and 270 lost-time cases of dermatitis in some 49,000 man-years of actual TNT exposure, making a rate of 12.5 lost-time cases per 1,000 man-years of exposure. This corresponded to a standard accident frequency rate of 5.2 per million man-hours of work for TNT-exposed employees. If the total number of man-years (226,000) representing all employees in production had been used instead of only the TNT-exposed employees as a base line for the calculation of rates, then the lost-time rate per 1,000 man-years would have dropped to 2.7 and the accident frequency rate to 1.1.

Here again, the lost-time cases per 1,000 man-years of exposure averaged less than eight for the last 15 months, as compared with more than 22 for the preceding 11 months.

Mild cases.—The number of mild, nondisabling cases which demonstrated early effects of TNT absorption were quite considerable, including over 11,000 cases of general or systemic effects and over 23,000 of mild dermatitis, giving overall rates of 230 and 476 per 1,000 man-years of exposure, respectively. Although the great majority of these cases were of little medical significance, they were all potentially serious lost-time cases and demonstrated vividly the real problems involved and the need for continued efforts to control TNT exposure. There was a rapid decline in mild cases from the peak rate of 1,205 in the third reporting period through the last six periods to a relatively low rate of about 300 in the last two periods, again despite a rapid increase in production.

Medical transfer cases.—From the production viewpoint of cost and efficiency, the unrecorded lost-time and effort caused by transfers away from TNT exposure of employees showing some early signs or symptoms of TNT poisoning or dermatitis was most important. Also, these employees all represented potential cases of severe illness or fatalities. While no figures were available for the first period, the total rate of transfers per 1,000 man-years of exposure rose from 418 in the second period to 569 in the third period and then declined to a relatively low level (about 150)

during the last two periods. Although the group of mild cases and the transfer group would overlap in many instances, that the two groups were different to some extent was shown by the overall mild case rate (706) which was $2\frac{1}{2}$ times the transfer rate (282), and by the dermatitis rate in the group of mild cases which started quite high (806) and steadily declined to 170 in the last period. In the transfer group, however, the dermatitis rate was relatively low and remained between 100 and 150 cases up to the last two periods, when it dropped to 67 and 23. These relatively low transfer rates for dermatitis were explained by the phenomenon of "hardening," that is, by the practice of keeping persons with mild dermatitis on the job until they lost their sensitivity. On the other hand, the mild case rate for systemic cases (230) exceeded the transfer rate by about one-third (168), and the curves were quite similar.

MANUFACTURING PLANTS

In the plants manufacturing TNT, as contrasted with loading plants, fewer workers were employed in production operations (about 36,000) and only about 5,200 were exposed to TNT. Many of these exposures were inconsequential in view of the enclosed nitration processes and the care taken to control operations which were not enclosed. Consequently, the number of cases of TNT poisoning and dermatitis were less than one-fifth of that in the loading plants, and the case rates per 1,000 man-years of TNT exposure averaged less than one-half.

Fatalities.—Only one death resulted from TNT poisoning and that occurred early in production, September 1942. Since that time no cases of serious illness due to TNT poisoning were reported. This death resulted in a fatality rate of 0.06 per 1,000 man-years of exposure to TNT, about one-sixth of that in the loading plants.

Lost-time cases.—Disabled or lost-time cases of TNT poisoning and dermatitis totaled 81, giving a case rate of 4.8 per 1,000 man-years of exposure to TNT, or a rate of 0.7 if the entire population in production were considered. These rates would yield standard accident frequency rates of 2.0 and 0.3, respectively, if considered on a million man-hour basis. There were no lost-time cases in two of the last four report periods.

Mild cases.—The case rates of mild or nondisabling TNT poisoning and dermatitis followed much the same pattern as in the loading plants. After a rise to a peak rate of 931 cases per 1,000 man-years of exposure in the third period, the rate fell to less than 300 in the fourth and dropped to 155 in the eighth and ninth periods, despite a very rapid rise in production during the last four periods. This decrease was heavily weighted by the dermatitis rates (707 to 142), although the systemic case rates decreased from a high of 224 to 13.

Medical transfer cases.—Workers transferred away from TNT exposure because of early symptoms of poisoning totaled 1,553, a case rate

of 116 per 1,000 man-years of exposure. Dermatitis accounted for 640 of these cases, while systemic effects accounted for 913. The transfer rate dropped from a high of 262 in the second period to about 50 for the last 2 periods, thereby indicating a considerable saving and improved efficiency. As in the loading plants, systemic effects accounted for the bulk of the transfers as workers with mild dermatitis were frequently kept on the job.

ARSENALS

Trinitrotoluene exposure and poisoning were not important problems in the old arsenals as only a few of these installations were loading TNT, and the number of employees exposed varied between 500 and 1,300. In all, there were two deaths, 15 lost-time cases, 418 cases of mild systemic effects or dermatitis, and 258 medical transfers among an average of 53,000 employees in 33 months of operation (fig. 27).

Improved control measures resulted in a favorable experience during the last year, as there were no deaths and only two lost-time cases, 21 mild cases, and 37 medical transfers among an average of 925 employees exposed to TNT. The rates, per thousand man-years of TNT exposure, for the last year were 2.2 for lost-time cases, 23 for mild cases, and 40 for medical transfers, which compared favorably with the rates for similar periods in the loading plants.

Tetryl

Exposure to tetryl, or trinitrophenylmethylnitrosamine, was limited almost entirely to the loading plants, TNT and tetryl manufacturing plants, and arsenals. These three industrial groups had an average employment of 167,400 in operations over an average period of 34.7 months, resulting in 482.6 thousand man-years of operations. As a rule, the first report period began in June 1942, usually with the beginning of operations in the new facilities.

Tetryl, used as a booster charge in large caliber ammunition and as the high explosive in small caliber shells, was next in importance to TNT in creating an occupational disease problem in loading and manufacturing plants. Because tetryl is a powerful sensitizer, a large proportion of new employees handling this material showed some degree of tetryl dermatitis. Its action sometimes caused local irritation of the conjunctiva, nose, throat, and bronchial tubes, thereby producing symptoms of the common cold, nosebleed, cough, and an occasional asthma-like syndrome until the workers were removed from exposure. No evidence of systemic or internal poisoning, that is, of the liver, heart, lungs, nervous system, or blood-forming organs, was reported from ordnance plants.

Lost-time cases.—There were 477 lost-time cases from exposure to tetryl, 460 from dermatitis, and 17 from other effects, resulting in an overall rate of one lost-time case per 1,000 man years of operations, or a



FIGURE 27.—Industrial dispensary, Frankford Arsenal, Philadelphia, Pa. A. Exterior view. B. Record room. C. Treatment room. D. Women's ward. E. X-ray room. F. Treatment room.

standard accident frequency rate of 0.4 per million man-hours. The great majority of these cases (445) occurred in the loading plants, which had a rate of two per 1,000 man-years of operations. This corresponds closely to the rate of 2.7 lost-time cases of TNT poisoning per 1,000 man-years of loading plant operations, described previously. Only two lost-time tetryl

cases occurred in the manufacturing plants, while 30 occurred in the arsenals.

Considerable improvement in the occurrence of lost-time cases of tetryl dermatitis was shown, as the rate for the last year was only 0.6 as compared with the overall rate of 0.95 per 1,000 man-years of operations.

Mild cases.—Although not of great medical significance, the mild, non-disabling effects of exposure to tetryl were numerous. In all, there were 19,924 cases of dermatitis and 2,192 cases with other mild effects, giving a total of 22,116 mild cases, or a case rate of 46 per 1,000 man-years of operations. Again, the great majority, 19,576 or 88 percent, of these cases occurred in the loading plants, while 3 percent occurred in the manufacturing plants and 9 percent occurred in the arsenals. The large labor turnover accounted for many of these cases, as new employees were especially prone to develop sensitivity to tetryl before becoming desensitized or "hardened." The annual labor turnover among wage earners in loading plants and manufacturing plants was about 100 percent and 66 percent, respectively, and it was estimated that the turnover in the arsenals was of similar order.

With increasing experience, technologic advances, and the emphasis on the industrial hygiene program, there was remarkable improvement in the incidence of tetryl dermatitis.

Medical transfer cases.—In the tendency of workers to overcome their sensitivity to tetryl, the majority of employees with dermatitis were kept on the job while attention was being given to controlling the exposure and to improving personal hygiene. Only those affected workers who showed no signs of becoming "hardened" or who showed extreme sensitivity were ordinarily transferred away from tetryl exposure permanently.

Despite this, the transfer rate improved considerably after remaining about the same for the second through the fifth report periods.

Oxides of Nitrogen

As the basic principle involved in the manufacture of high explosives and smokeless powder was the nitration of organic compounds, the prevention of exposure to lethal concentrations of the oxides of nitrogen, so-called nitrous fumes, was of paramount importance. These processes were largely enclosed in ordnance works, and where there was the possibility of leakage, exhaust ventilation was provided. Accordingly, the chances for serious exposure during normal operations were not great unless there was an accidental spill or a breakdown in equipment.

Because a serious exposure to oxides of nitrogen may be followed by a latent period, then a sudden onset of congestion of the lungs which may progress rapidly to shock and death, if not vigorously treated, every effort was made throughout the industry to impress supervisory personnel and employees with the necessity for prompt medical observation and treatment of any workers exposed to unusual concentrations, the effects of which closely simulate those of phosgene. Plant hospitals also kept oxygen

breathing equipment for the early treatment of cases. Pure oxygen was often given by mask under positive pressure.

Exposure to the oxides of nitrogen was confined almost entirely to three industries—the smokeless powder works, the TNT and explosives works, and the chemical works. The average number of employees engaged in production operations in these plants was 60,200 for an average duration of slightly more than 3 years (36.8 months), resulting in a total of 184.9 thousand man-years of operations. Data as to the actual number of employees potentially exposed to oxides of nitrogen were not available, but they were considered sufficient to justify periodic physical examinations.

Fatalities.—Only three fatalities were reported as attributable to exposure to oxides of nitrogen, two in the powder works, and one in TNT manufacture—resulting in fatality rate of 0.02 per 1,000 man-years of operations. This was considered a remarkably good record in the tremendous magnitude of nitrating operations and was thought to reflect great credit upon the control measures instituted by the plants and the effectiveness of their medical program. Two of the fatalities occurred early in operations and one in the second year.

Lost-time cases.—Remarkably few employees were sufficiently exposed to the oxides of nitrogen to lose time from work, the total number being 155, or an overall case rate of less than one (0.8) per 1,000 men per year. Considerable progress is shown even here as all but nine of the cases occurred in the first four report periods, and there was none reported in the last two periods. The average rate for the last five report periods was only 0.1 as compared with the overall rate of 0.8 per 1,000 man-years of operations. The smokeless powder works had no lost-time cases in the last five report periods and the chemical works had none at all.

Many of these lost-time cases were found to be of little medical significance, but the employees were hospitalized for a few days for moderate symptoms as a precautionary measure. However, a few employees were known to have been treated who had severe pulmonary edema and extensive mottling of the chest X-ray film and who responded promptly to treatment and appeared to be entirely well within a few weeks.

Mild cases.—The total number of mild, nondisabling cases was 4,185, resulting in a rate of 23 cases per 1,000 man-years of operations. The great majority of these cases (3,442) occurred in the TNT works, while 718 were reported from the powder works and 25 from the chemical works. Most of them were characterized by either mild complaints attributed to exposure to oxides of nitrogen or minor degrees of irritation of the respiratory tract that did not justify extended treatment. In numerous instances, the affected employees were observed at the plant dispensary for several hours to be certain that no serious effects would develop.

Medical transfer cases.—Medical transfers because of exposure to oxides of nitrogen were not a problem, the total number being only 30.

These were largely cases in which workers because of some real or fancied sensitivity to "fumes" kept complaining until moved to other work.

Other Occupational Diseases

Bomb and shell loading plants.—In addition to the problem of TNT poisoning and tetryl dermatitis, there was a fairly large number of exposures to toxic substances associated with the loading of shells, bombs, fuses, and their components, and with their final processing for shipment overseas. Dermatitis accounted for the majority of occupational disease experience in the loading plants.

Among the mild systemic cases, ammonium picrate, solvents, primer mix, PETN, nitroglycerine, DNT, and cadmium were responsible. The cases resulting from exposure to ammonium picrate and primer mix were chiefly characterized by irritation of the upper respiratory tract. Dermatitis was attributed to many causes but principally to mercury fulminate, ammonium picrate, solvents, black powder, primer and tracer mix, smokeless powder, PETN, graphite, lead oxide, ammonium nitrate, pentachlorophenol, cutting oils, and soap. Many of these cases were quite mild, and it is questionable whether all should be considered as occupational.

Manufacturing plants.—As in the loading plants, there was a considerable number of toxic exposures to substances other than TNT, tetryl, and oxides of nitrogen in the plants manufacturing explosives. Systemic cases reported here resulted from exposure to DNT, acids, lead, aniline, ether, nitroglycerine, carbon monoxide, ammonia, and solvents. The dermatitis cases were attributed to acids, DNT, RDX, PETN, cutting oils, alkalines, sellite, soap compounds, and protective gloves and uniforms. Because of changes in production, there was considerable fluctuation in the relative importance of the various exposures in different report periods.

Smokeless powder works.—While the number of lost-time cases was negligible, there was a considerable number of mild cases and medical transfers in smokeless powder works. The mild systemic effects were caused chiefly by exposure to DNT, although exposures to aniline, nitroglycerine, TNT, ether-alcohol, and acid each caused a fair number of cases. The cases of dermatitis were attributed to exposures to DNT, tetryl, TNT, acid, solvents, xylydine, dimethyl-aniline, double-base powder, and cutting oil. The number of occupational diseases decreased considerably as the control program became more effective.

Miscellaneous chemical works.—An average total of 4,400 employees was engaged for an average of 31 months in the miscellaneous chemical works, resulting in 11.4 thousand man-years of operation. Aside from the potential hazard of exposure to oxides of nitrogen, which caused no lost-time cases, the occupational disease hazards were relatively slight. Systemic cases were attributed chiefly to carbon monoxide exposure and to the irritating effects of ammonium picrate and acids on the upper

respiratory tract, while the dermatitis cases resulted from exposure to ammonium picrate, hexamine, acids, and solvents.

Small arms ammunition plants.—In small arms ammunition plants an average number of 85,000 employees was engaged in production over 33½ months, resulting in 237.4 thousand man-years of operations. Although there were many potential health hazards, they were well controlled and little systemic poisoning was reported. However, dermatitis was an important problem in many of the operations. Systemic effects were caused by barium salts, welding fumes, TNT, cleaning fluids, lacquer fumes, trichloroethylene, and cutting oil mists. Dermatitis was attributed to cutting oils, solvents, tracer and primer mixtures, TNT, smokeless powder, Carboloy (tungsten carbide) acids, alkalies, drawing solutions, paint, soap, greases, uniforms and gloves, mercury fulminate, and numerous other minor exposures.

Arsenals.—In the old Army-operated arsenals, occupational disease reports covered an average of 53,000 employees engaged in actual production over 32.7 months, or 144.4 thousand man-years of operations. The different arsenals were engaged in many varied and changing activities during the war and so were not strictly comparable with each other or with other industrial groups. There was slight improvement in systemic case rates the last year, but there appeared to be little or no improvement in rates for mild dermatitis. Systemic effects were caused chiefly by exposure to carbon monoxide, DNT, lead, solvents, mustard gas, chlorine, nitroglycerine, and incendiary mixtures, while the dermatitis was attributed to exposure to cutting oil, solvents, tetrytol (mixture of tetryl and TNT), rouge, creosote, mustard gas, incendiary mixtures, tear gas, smokeless and black powder, fulminate of mercury, protective oils, acids, and alkalies. Medical transfers from these miscellaneous causes were not a serious problem. Very few transfers were made because of systemic effects during the last five report periods, but the transfer rate for dermatitis remained fairly uniform throughout, excepting an elevated rate of six per 1,000 man-years in the sixth period.

Ordnance depots.—Occupational diseases were not a widespread problem in ordnance depots, as a great majority of employees were engaged in handling finished products. There were, however, sufficient exposures to toxic substances in maintenance shops and renovating operations to justify close supervision and control. Early in production, a few plants were loading TNT, but this was largely discontinued. In these depots, an average of 24,800 employees was engaged in operations over 32.1 months, resulting in 66.3 thousand man-years of operations. The bulk of the systemic cases was due to exposure to TNT and occurred early in production when more of the depots were loading or renovating shells on a relatively small scale. Other factors were oxides of nitrogen, phosgene, and carbon monoxide. The dermatitis was caused chiefly by exposure to

TNT, although exposure to solvents, pentachlorophenol, cutting oil, mustard gas, creosote, and acids all resulted in a number of cases.

Proving grounds.—Reports on occupational diseases from the ordnance proving grounds covered an average of 7,200 employees in operations for 38 months, or 22.6 thousand man-years of operations. Because of the nature of these operations, relatively few employees were exposed to significant concentrations of toxic substances. The occurrence of mild cases appeared rather irregular, and no definite trend was observed by report periods. The systemic cases were caused by carbon monoxide, nitroglycerine, TNT, oxides of nitrogen, gasoline, and acetylene, while the dermatitis was caused principally by solvents, TNT, poison ivy, cutting oil, smokeless powder, soap, and miscellaneous explosive compounds. The transfer of workers to jobs free from exposure because of occupational diseases was a minor problem at the proving grounds. Only 36 transfers were made, chiefly because of exposure to solvents, double-base powder, TNT, and acetylene.

Bag-loading plants.—The number of employees engaged in operations in bag-loading plants averaged 9,100 for 43 months, resulting in 32.5 thousand man-years of operations. Practically no uncontrolled health hazards were associated with these operations, and consequently, few occupational diseases were reported. Only one lost-time case was reported (cutting oil dermatitis), which gives a rate of 0.03 per 1,000 man-years, or an accident frequency rate of 0.01, by far the lowest for all industries. Nine cases of mild dermatitis were reported—eight attributed to black powder, and one thought to be due to handling powder bags. Six medical transfers resulted from exposure to black powder. The lack of any poisoning or dermatitis from handling large quantities of finished single-base smokeless powder strongly indicates that this compound was not a significant health hazard.

Summary and Evaluation of Program

These data show the results of an extensive industrial health and hygiene program upon the incidence of occupational diseases in 101 Government-owned ordnance explosives establishments with an average of 309,000 employees engaged in operations with potential exposure to many toxic materials. The 10 report periods covered an average of more than 37 months of operations during World War II for plants that produced 95 percent of all military explosives in the United States.

The coordinated resources of the Ordnance Department, the Medical Department, and the U.S. Public Health Service were fully utilized in this effort to prevent occupational illness and to facilitate the production of ammunition by keeping workers fit and on the job. Semiannual or annual industrial hygiene surveys were made by teams of trained physicians, engineers, and chemists of all plants having significant health hazards. Resulting recommendations for improving medical services and controlling health

hazards were followed up and enforced through operational channels. Research was done on the toxicology of explosives. Meetings were held with plant physicians and engineers to bring together all new information and experience. Special technical consultations and studies were available to the plants as new problems arose and correspondence on technical matters was maintained. Circulars were distributed to the plants giving timely information on health and hygiene.

A summary of the results of this medical and engineering program upon the incidence of occupational diseases in the Government-owned ordnance explosives establishments shows that in 968,000 man-years of operations there was a total of only 28 occupational disease fatalities (22 from TNT, three from oxides of nitrogen, two from carbon tetrachloride, and one from ethyl ether). This gives a rate of less than three fatalities per 100,000 workers per year. Of these 28 fatalities, only six occurred in the last 18 months of the war. The fatality rate is only a small fraction of that shown by incomplete reports for very limited explosives production during World War I.

During World War II, there were only 2.4 cases per 1,000 man-years of production of occupational illness and dermatitis sufficiently severe to cause lost time from work. The quarterly rates were reduced from a peak of 3.8 in the spring of 1943 to an average of 1.4 for the last year of operations, a decrease of 63 percent, despite a great increase in production. Dermatitis accounted for two-thirds of these lost-time cases, which left the more serious general, systemic, type of poisoning with an overall rate of less than one (0.8) case per 1,000 man-years of production.

Among the 76,000 operating employees in shell and bomb loading plants, TNT poisoning was by far the principal health problem in the nine industrial groups and accounted for 19 of the total fatalities, but only five of these occurred in the last 18 months of production, as compared with 14 in the preceding 20 months. Among an average of 16,700 employees actually exposed to significant concentrates of TNT in these plants, the lost-time case rates fell from a peak of 29 per 1,000 man-years of exposure in the spring of 1943 to an average of less than eight for the last six quarterly report periods. This represented a reduction of more than 70 percent despite an increase in production.

In the TNT manufacturing works, among an average of 5,600 employees exposed to TNT in 40 months of operations, there was only one fatality. The rates for lost-time cases due to exposure to TNT declined from a peak of 12.7 per 1,000 man-years of exposure in the first report period to an average of less than two during the last seven report periods, a reduction of 85 percent.

Similar improvement was noted in the control of disability caused by exposure to tetryl and oxides of nitrogen. In the three industrial groups (loading plants, manufacturing plants, and arsenals) offering significant exposures to tetryl, among an average of 163,000 employees, the lost-time

case rate dropped from 1.5 in the first report period to an average of 0.6 for the last six report periods, a reduction of more than 65 percent. Exposure to the oxides of nitrogen was a potential hazard to the 59,000 operating employees in the powder works, TNT works, and miscellaneous chemical works. Three fatalities resulted in a rate of less than two deaths per 100,000 man-years of operations, and none occurred in the last five quarterly report periods. Less than one case (0.8) of disabling illness occurred per 1,000 man-years of operation. The lost-time rates declined from a peak of 1.9 in the second report period to an average of 0.15 per 1,000 man-years in the last six report periods, a reduction of over 90 percent.

Cases of mild or nondisabling occupational diseases were reported along with the lost-time cases. These were usually of little significance from a medical viewpoint but served as an additional index to the scope of the problems involved and the success of the control program. The trend and distribution of cases of mild illness resulting from different exposures were similar in pattern to the lost-time cases. Among all employees engaged in operations in all plants, the mild case rate from all exposures dropped rapidly from a peak of 124 per 1,000 man-years of operations in the first report period, to an average of 59 for the last three periods, a reduction of more than one-half. With regard to the more serious exposures, the reduction in mild cases from TNT, tetryl, and oxides of nitrogen was even greater.

Workers showing sufficient symptoms of exposure to toxic substances were frequently transferred to other jobs by the plant medical departments as a precaution against the development of disabling illness until the exposure could be controlled more effectively. These cases were generally of little significance, but better control of the exposures and personal hygiene reduced the need for medical transfers, resulting in more efficient production and a decided saving in costs.

The rate of medical transfers for all exposures in all plants dropped from a peak of 44 per 1,000 man-years of operations in the third report period to an average of 22.5 for the last four report periods, a reduction of almost one-half, despite a great increase in production. It was believed that from an economic viewpoint alone, this reduction in the need for transferring workers away from their jobs more than justified the entire industrial hygiene program.

So far as was known, this was the first large-scale demonstration of what a vigorous, coordinated industrial health and hygiene program could accomplish by preventing illness and conserving manpower in the explosives industry, which included privately owned and operated, Government-owned and Government-operated, and Government-owned and contractor-operated plants. Despite the difficulties associated with rapidly increasing production of explosives, unskilled labor, a high labor turnover, and frequent changes of production processes and schedules during more than 37 months in World War II, a marked reduction was effected in the prevalence of occu-

pational disease fatalities and disabling and nondisabling illnesses, and in the transfer of workers away from their regular jobs because of occupational diseases.

Also, despite the magnitude of explosive production, the total of 22 TNT fatalities represents a small fraction of the 475 fatalities reported from TNT and related compounds during limited production in World War I. From all available evidence, it was believed that the results of this industrial hygiene program in World War II compared favorably with those of the ordnance safety program. The Chief of Ordnance stated that during World War I, the United States facilities which produced 40 percent of military explosives used by the Allies reported a ratio of 230 fatalities per billion pounds of explosives manufactured. In this war, the Government-owned, contractor-operated plants producing 95 percent of all military explosives manufactured in the United States suffered only five fatalities per billion pounds of explosives produced.

ARMY INDUSTRIAL HYGIENE LABORATORY

The successful accomplishment of occupational medicine depends upon two phases: (1) Medical supervision of the individual worker, and (2) proper control of his environment. This second phase lies largely in the field of engineering and related disciplines. The establishment of a laboratory necessary to support this work had been authorized on 5 January 1942.³⁷ Colonel Lanza's first responsibility on his appointment as chief of the Occupational Health Division was to hasten its activation. It was originally intended to locate the Army Industrial Hygiene Laboratory at the Army Medical Center; difficulties and delays were encountered, and Colonel Lanza received permission from the dean of The Johns Hopkins University School of Public Health to occupy temporary quarters in the school. This cooperation, for which great credit is due, enabled the staff to begin work without delay, even before the official activation of the Army Industrial Hygiene Laboratory on 17 October 1942. As in many other instances, temporary quarters gradually became semipermanent ones, and so the Army Industrial Hygiene Laboratory remained in Baltimore until the end of the war. On 1 October 1945, it was transferred to Edgewood Arsenal, Md. At that time, it also assumed the function and activities of the Occupational Health Division (Preventive Medicine Service, Surgeon General's Office), which was deactivated on that same date.³⁸

Mission and Status

The mission of the Army Industrial Hygiene Laboratory was to "conduct surveys and investigations concerning occupational health haz-

³⁷ (1) See footnote 7, p. 105. (2) Third Service Command General Order No. 89, 21 Oct. 1942.

³⁸ See footnote 19, p. 130.

ards in Army-owned and Army-operated industrial plants, arsenals, and depots.”³⁹ The fulfillment of this mission necessitated official travel by laboratory personnel to Army installations in all nine service commands. Since there was no precedent regarding the organization of an installation of this type as a military establishment, considerable difficulty was experienced in determining its status. To resolve difficulties encountered in conducting studies in other service commands on orders issued by the Third Service Command, the laboratory’s status as the 1366th (Third) Service Command Unit was changed, and in April 1943, the laboratory became a class IV installation under the jurisdiction of The Surgeon General.

Personnel

At its inception, the laboratory was staffed by five Sanitary Corps officers, an enlisted man, and three civilians (a clerk-stenographer, a chemist, and a laboratory helper).⁴⁰ The officers were the first of a large group who, because of extensive training or experience or both in industrial hygiene, were being commissioned directly from civilian life (in a few cases from the ranks) to participate in the development of the Army industrial medical program. As the laboratory’s participation in the program expanded, the staff of the laboratory grew to a peak strength of 23 Sanitary Corps officers, two Medical Corps officers with industrial medical experience, an adjutant, a medical supply officer, a WAC (Women’s Army Corps) officer (detailed in the Medical Administrative Corps) who acted as technical administrative assistant, two (WAC) enlisted women, and 19 civilian employees.⁴¹

In February 1943, the professional activities of the laboratory, which was commanded by Capt. (later Lt. Col.) Henry N. Parrish, a Sanitary Corps officer, were put under the direction of a civilian scientific director, Dr. Raymond G. Hussey, a physician with a rich background of industrial medical and industrial hygiene experience. However, dual direction of the laboratory proved unsatisfactory; in June 1943, Dr. Hussey was given leave of absence, commissioned lieutenant colonel in the Medical Corps, and assigned as the commanding officer.

Training

Soon after the laboratory was organized, it became apparent that because the experience of the Sanitary Corps officers had been gained in a wide variety of situations (such as State and city health departments, U.S. Public Health Service, industrial corporations and insurance companies), it was necessary to indoctrinate them with the operating procedures adopted for the Army industrial hygiene program. Therefore, a

³⁹ War Department Circular Letter No. 145, Office of The Surgeon General, U.S. Army, 5 Nov. 1942.

⁴⁰ Annual Report, Army Industrial Hygiene Laboratory, Baltimore, Md., 1943.

⁴¹ Third Annual Report, Army Industrial Hygiene Laboratory, 1944.

training course was established in 1943. It was conducted by an officer and an enlisted man from the Army Industrial Hygiene Laboratory, using the facilities of Middletown Air Depot, Olmstead Field, Middletown, Pa. Of the Sanitary Corps officers trained there, 21 were retained on the staff of the Army Industrial Hygiene Laboratory and seven were further trained at the laboratory in Baltimore for assignment as industrial hygiene engineers at Army industrial installations.

Organization and Activities

By October 1943, the work of the laboratory had so increased in volume and complexity that its professional activities were organized under the following sections: Surveys (later Industrial Hygiene Surveys), Plans (later Engineering Design and Development), Chemistry and Toxicology (later Chemistry, Medicine, Instruction, and Statistics). The Instruction Section was disbanded in 1945 after its mission was completed, and the activities of the Statistics Section were absorbed by other sections. The activities of the four technical sections remaining at the end of the war are discussed below. Chart 4 shows the organization and personnel strength of the laboratory, 1 July 1945.

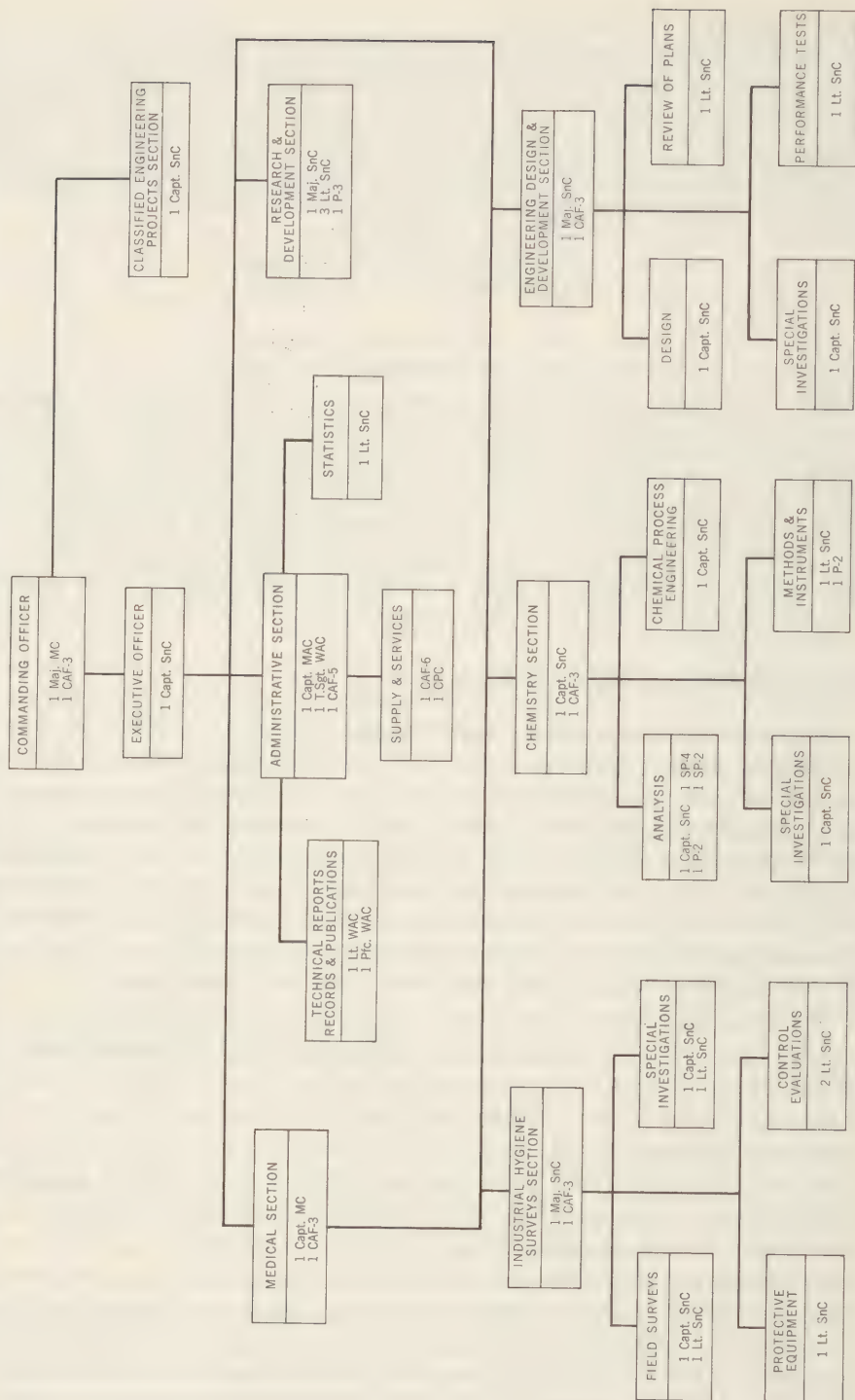
Industrial Hygiene Surveys Section

Mission.—The mission of the Industrial Hygiene Surveys Section was to observe and record exposures to which workers were subjected in connection with atmospheric contaminants, illumination, noise, and ventilation; to determine which exposures constituted health hazards; to inform the commanding officer of an industrial installation of unsatisfactory conditions; to prepare reports on these conditions, including recommendations for their control or elimination, and to determine the effectiveness of recommended control measures after installation of the control equipment or other changes in reported unsatisfactory conditions.

Procedures.—There were five major steps in conducting industrial hygiene surveys. The first step was concerned with the observation of all industrial operations at the installation being surveyed and the recording of all exposures to toxic materials resulting from or incident to these operations. When the industrial hygiene engineer encountered new operations or found new chemicals and materials being used in conjunction with familiar operations, he was prepared to study the process and to determine whether exposure to toxic materials existed.

The second step of the survey involved the evaluation of exposures to determine whether they were serious enough to create hazards. It should be pointed out here that the Army Industrial Hygiene Laboratory used the term "exposure" to indicate operations or processes with which were associated harmful materials, without any reference to the degree or

CHART 4.—*Organization chart, Army Industrial Hygiene Laboratory, Army Service Forces, 1 July 1945*



extent of exposure. Only when harmful materials were found to exist in concentrations sufficient to cause damage to health were they termed "hazards." The exposure was evaluated by sampling the atmosphere in which the employee worked or by analyzing the material with which the employee came in contact. In many atmospheric contaminants (carbon monoxide, benzol, and combustible gases), unusual atmospheric conditions such as high temperature and excessive humidity, or insufficient illumination, the industrial hygienist had at his disposal instruments which enabled him to determine immediately whether occupational hazards existed. When the exposure involved such toxic contaminants as dust, metal fumes, chlorinated hydrocarbons, or materials resulting in exposures due to contact, such as cleaning compounds in which the employee immersed his hands or which splattered on exposed skin surfaces, the industrial hygienist collected samples which were analyzed subsequently by personnel assigned to the Chemistry Section, Army Industrial Hygiene Laboratory. Consequently, the workload of the Chemistry Section depended somewhat on the activities of the Industrial Hygiene Surveys Section. It was necessary that the industrial hygienist conducting a survey have a working knowledge of the instruments he used, and a basic knowledge of the chemical methods and procedures followed by the Chemistry Section in the analysis of samples. A list of contaminants, with recommended methods of collection, was compiled by the Army Industrial Hygiene Laboratory.⁴² Although it was prepared for the use of officers assigned to the Industrial Hygiene Surveys Section, many of the industrial hygiene engineers assigned to industrial installations requested a copy to use as a guide in collecting samples.

The study of personal hygiene included the working habits of employees; the availability, use, servicing, and maintenance of personal protective devices, such as respirators, masks, and helmets; and the availability and use of protective creams and ointments. The extent and adequacy of supervision of processes and the training and education of employees engaged in the operation were considered. These factors had much bearing on the recommendation which was made to control a hazard.

The third step in conducting industrial hygiene surveys was the submission of recommendations for the control of health hazards. A primary consideration in determining the type of control to be recommended was the necessity for controlling the hazard without interrupting the activities of the operation or process, or decreasing or hampering the workman's productivity. The recommendation submitted by the laboratory to the commanding officer of an installation had to be practical, brief (yet include pertinent details), and as inexpensive in accomplishment as possible.

The recommendations for control of hazards varied considerably. Segregation of processes so that employees engaged in nonhazardous operations would not be exposed, and enclosure and isolation of hazardous

⁴² Army Industrial Hygiene Laboratory Memorandum No. 5, 27 Mar. 1945.

processes both served to reduce the number of persons exposed. The complete isolation of workers using radioactive materials and of those using rubber cements containing benzol are examples. Often the provision of and use of proper respirators, protective clothing, and protective creams served to prevent the occurrence of occupational illnesses, although it should be emphasized that the use of respirators was considered as a temporary protective measure until more permanent control measures could be instituted. Wet methods for reducing exposures to dusts produced in the cleaning of metal castings or in grinding operations were often adequate.

As will be discussed later (pp. 175-179), the majority of exposures required mechanical ventilation for adequate control. Changes in ventilation systems were recommended only after consultation with representatives of the Engineering Design and Development Section, Army Industrial Hygiene Laboratory. Only when all other methods were impractical or impossible was the hazard controlled through reducing the length of exposure to it by rotation of employees so that each employee was exposed fewer hours per day or fewer days per week. Finally, certain hazards required medical control measures. The recommendations for these were submitted by medical officers on the staff of the laboratory.

The fourth step in conducting a survey was the presentation of findings and recommendations to the commanding officer of the installation surveyed. Generally, this was done at a conference with the commanding officer, post surgeon, industrial medical officer, post safety officer, post safety engineer, and such other key personnel as the commanding officer might designate. The commanding officer, plant superintendent, or chief of operations was able to indicate the practicability of recommendations from an operational viewpoint before the preparation and submission of a formal report. Obvious benefits were provided to both the laboratory and the installation by this procedure.

The fifth and final step was the preparation and submission, through channels, of a formal report. The reports of surveys prepared by this section varied considerably during the development of the laboratory. Originally, officers prepared reports according to their individual styles developed as civilians. Reports tended to be verbose yet were not understandable to laymen; military form was not followed; and in some cases, recommendations for control of exposures were submitted without substantiation of the existence of an actual hazard. Eventually, a standard report form was developed which eliminated many of the earlier criticisms.

Field activities.—Officers assigned to the Industrial Hygiene Surveys Section spent most of their time in field work. The studies conducted in the field were classified as reconnaissance surveys, surveys, special investigations, and inspections of installations.

A reconnaissance survey consisted of an investigation of all operations and processes to determine all exposures to toxic materials and to select

for detailed study those operations which presented potential hazards. It was conducted before the regular industrial hygiene survey.

Special investigations were carried out in a manner similar to regular surveys except that the reconnaissance survey was omitted and only certain specific operations, processes, or hazardous materials were studied.

Inspections were visits to installations for discussion of specific problems which did not require detailed engineering study. In addition inspections included determination of compliance with recommendations for adequacy of control measures.

The field assignments of officers of the Industrial Hygiene Surveys Section took them into a total of 98 installations, of which 83 were Army-owned, Army-operated, and 15 were privately owned and privately operated plants. The total number of field assignments was 255, classified as follows: Surveys, 86; special investigations, 86; separate reconnaissance surveys, 19; and inspections, 64.⁴³ Three assignments were to installations outside the continental United States. Of the privately operated plants, 10 had contracts with the Quartermaster Corps and five were producing material for the Chemical Warfare Service. More than one-half of the exposures (58.9 percent) to atmospheric contaminants in Army-owned and Army-operated industrial installations resulted from the use of liquids—solvents being the most frequent class of toxic material encountered. Paint mists, carbon monoxide, and lead fumes were the other chief contaminants. The relatively low number of toxic exposures to explosives was a result of the industrial hygiene program directed by representatives of The Surgeon General assigned to the Safety and Security Division, Office of the Chief of Ordnance.

Engineering Design and Development Section

Mission.—The primary mission of the Engineering Design and Development Section of the Army Industrial Hygiene Laboratory was to furnish basic engineering information on the design and performance of mechanical airflow systems for the control of atmospheric contaminants in Army-owned and Army-operated industrial installations. Most of the problems involved the control of toxic materials disseminated in the form of gases, vapors, fumes, and dusts, but in a number of cases the objective was to recondition the air in working areas through the control of temperature, humidity, and air motion. Although this latter phase of the work of the section was not always directed toward the control of specific health hazards, it was done in the interests of improved working conditions and only when some substantial increase in the workers' efficiency was to be gained.

⁴³ (1) See footnote 14, p. 124. (2) Special Investigations, Industrial Hygiene Surveys Section, Army Industrial Hygiene Laboratory, October 1942 to August 1945. (3) Chronological list of separate reconnaissance surveys, Army Industrial Hygiene Laboratory, April 1943 to February 1945. (4) Chronological list of plant inspections, Army Industrial Hygiene Laboratory, October 1944 to December 1945.

Activities.—The major activities of the section were the preparation of original designs, review of recommendations of the Industrial Hygiene Surveys Section, and the carrying out of mechanical performance tests.

Although much of the work of the Engineering Design and Development Section was done to follow up industrial hygiene studies made by the Industrial Hygiene Surveys Section of the Army Industrial Hygiene Laboratory, it at times participated directly in the work of the latter section, largely through the formulation of specific engineering recommendations for ventilating systems. In all other activities, this section functioned chiefly as an independent unit, and its officers were assigned to work in the field with interested personnel at Army industrial installations.

Although authority to carry on work in design usually was obtained through the medical offices at the field installations, activities in most cases centered in the engineering offices, such as those of post or area engineers, or the civilian district or consulting engineers. The section served largely in a consultative capacity.

Preliminary designs, layout sketches, and specifications, together with recommendations for types of commercial equipment, were furnished the plant engineers, and supervision was provided in the preparation of final working drawings. For example, after a request had been submitted to the Army Industrial Hygiene Laboratory for assistance in the preparation of designs, an officer from the section was assigned to the installation on temporary duty and worked directly with the plant engineers. The officer was then able to render the most effective service to the installation because (1) he could maintain close liaison with the plant engineers and other persons responsible for the work, (2) he had opportunity to study the industrial processes involved during the progress of the work, and (3) he could take full advantage of the practical ideas commonly offered by plant workers and supervisors. In this manner, the most economic use was made of the few officers in the section, since it was possible for one officer to devote his main attention to the more important factors of design while the field measurements, layouts, and drafting were carried on by the personnel assigned to the plant.

In principle, such a working arrangement was ideal for expediting the work of the section and for utilizing the officers' experience in the field of industrial ventilation. In practice, however, officers at the industrial installations did not take much advantage of this design service available upon request and on many projects where the design service was actually rendered, plant officers were not inclined to lend the necessary support to realize fully the objectives of the service as outlined by Army Industrial Hygiene Laboratory.

One reason that the design service was not fully utilized was that the managements of a large number of the Army industrial installations apparently were not aware of the scope or type of service which could be

provided by the Army Industrial Hygiene Laboratory. Moreover, in some installations in which industrial hygiene surveys had already been made, the engineering departments were not informed that laboratory personnel were available to help them in the design of air handling systems for the control of atmospheric contaminants. Finally, industrial engineering personnel were often reluctant to solicit or even to accept assistance in design from an outside agency even though they might be faced with unfamiliar problems involving the control of toxic materials.

Preparation of original designs.—In the preparation of original designs and specifications for industrial ventilation systems, the Engineering Design and Development Section was called upon to consider all essential factors entering into each problem. In keeping with sound engineering principles, therefore, the objective of this work was to control adequately atmospheric contaminants by use of minimum airflow, with minimum interference with operations involved in a manufacturing process, and with the least initial and maintenance costs.

Since most of the problems assigned to this section involved the removal or control of atmospheric contaminants, the source of which could be readily traced to specific industrial processes, the designs made were largely for local exhaust ventilation systems. For such systems, the basis of design was to provide for controlled air movement at the source of contamination with sufficient velocities at all points effectively to remove the contaminant from the worker's breathing zone and thus maintain safe and healthful working conditions. The general principle involved was not complex, but the designer was often faced with limitations imposed by existing structural or operational conditions which required that the most exacting use be made of the airflow available for control purposes.

Since, without recirculation, each unit of airflow in the operation of an exhaust system must be replaced with an equal amount of outside air, the problem of heating this "makeup" air in winter was often of major importance. On several of the projects, the available supply of outdoor heated makeup air was so limited that it was not possible to provide for adequate control of ventilation without considerable enlargement of the heating plants. Therefore, as already pointed out, the principal objective in the designs prepared by the section was to obtain maximum control of contaminants with a minimum airflow. In addition to specifying sizes and shapes of exhaust hoods, together with sizes of pipes, fans, and motors, the drawings also showed recommended contaminant collector units and the method of final disposal of contaminants. It was necessary, therefore, that the designer be familiar with the types of commercial equipment available and with the performance to be expected under many conditions of plant operation.

In the majority of the Army industrial plants which were studied by this laboratory, no satisfactory plans had been made for the control of occupational health hazards when the plants were designed. Consequently,

any subsequent designs for control systems had to be adjusted to existing plant conditions even though the final result was not considered entirely satisfactory. While the advantage of providing for adequate systems for control of ventilation during the design of an industrial plant was well recognized, the records of the Army Industrial Hygiene Laboratory showed that its services were requested during the planning stage on only a few of the many new Army industrial projects.

Although most of the designs prepared by this section were for exhaust systems, a number were for forced air systems. In general, the purpose of the latter was to relieve abnormal temperature and humidity and to establish good air circulation in working areas.

Review of recommendations.—In the preparation of industrial hygiene engineering survey reports in which mechanical ventilation systems were to be recommended, this section furnished brief but basic specifications for their design. In addition, the following statement was usually included: "If assistance is desired in designing or reviewing plans for any ventilation system, it will be furnished by the Army Industrial Hygiene Laboratory, Engineering Design and Development Section, upon request through channels." As a result, many of the requests for independent investigation with more complete design were initiated by installations as a followup of survey recommendations.

The information given in the survey reports specified the type and relative position of the exhaust hood or enclosure for a given operation together with the volume rates of airflow and air velocities at strategic points deemed necessary to control the escape of the toxic materials within safe limits. This was usually stated in general terms, and a more detailed description of the process was often considered adequate to form a basis of design, provided that the operations were not complex.

Many problems in design which were brought to the attention of the Engineering Design and Development Section through the review of reports of the Surveys Section involved the control of (1) carbon monoxide from the operation of internal combustion engines in garages, testrooms, and warehouses; (2) lead fumes and dust and carbon monoxide in firing ranges; (3) metal fumes and oxides of nitrogen from welding operations; (4) toxic pigments and organic solvent vapors and mists from spraying operations; (5) pneumoconiosis-producing dusts from abrasive blasting and cleaning operations; (6) acid mists from plating and cleaning operations; and (7) chlorinated hydrocarbon and other organic solvent vapors from degreasing. The location of a hazardous operation in the plant and the feasibility of isolating it from other working areas without interfering with production were important considerations in determining the type and capacity of a given ventilation system. Furthermore, internal pressure conditions in the building, which were commonly influenced by the operation of other ventilation systems, and the provisions for replenishing the

supply of air from the outside determined recommendations on the types and capacities of fans to be used.

Performance tests.—To insure that the designs recommended by the Army Industrial Hygiene Laboratory were followed in all essential details and that any changes or adjustments could be recommended, it was considered necessary that performance tests be made soon after a system was put into operation. Performance tests as carried on by this section included (1) linear velocity measurements in the zone of contamination and at strategic points in the duct system; (2) air pressure determination in the ducts and at the inlet and outlet of the fan; and (3) motor power consumption by electric current measurements and, thus, the power consumption of the fan itself.

For measuring the total airflow and static pressures in duct systems, the standard Pitot tube and inclined gage were used and complete traverses were made at each designated point of measurement.

For measuring linear rates of air movement outside the duct system in the zone of contamination, the Pitot tube could not be used because velocities generally were below 500 feet per minute with corresponding velocity pressures below 1/64-inch water gage. Therefore, a direct reading instrument, such as the vane anemometer or the velometer, was used for all low velocity determination. Both instruments were found to have definite disadvantages in that the calibrations were based on controlled conditions, but they were selected for the work of this laboratory over other commercial instruments and were used successfully on most of the projects.

Between 1 October 1943 and 30 September 1945, a total of 464 projects were undertaken by this section. The basic design for 409 of them had been made by the Army Industrial Hygiene Laboratory.

Chemistry Section

Mission.—The Chemistry Section maintained and operated a chemical laboratory for analyses and investigations, furnished data for the Army Industrial Hygiene Laboratory, and provided information requested by other Army installations in the course of industrial hygiene investigations.

The section was chiefly concerned with the analyses for possible harmful constituents of samples sent in from Army industrial installations and, in addition, made certain investigations of a chemical nature at installations. They developed new and improved methods of sampling (especially for atmospheric samples) and analysis, studied process control of chemical operations which involved potential health hazards, and participated in investigations of various chemical substances or chemical treatments already in use or proposed for use by the Army. The last-named activity included chemical analyses, consultation with various authorities, and review of the literature to furnish the Medicine Section, Army Indus-

trial Hygiene Laboratory, with data upon which to base a statement of the physiologic ill effects possible from the use of a substance or process.

Incident to its other activities, the Chemistry Section calibrated and checked the sampling and testing instruments used by the Industrial Hygiene Surveys Section and, upon request, similar instruments sent in by industrial hygiene officers permanently assigned to Army industrial installations.

Procedures and activities.—The samples analyzed were submitted by survey teams from the Army Industrial Hygiene Laboratory or by industrial hygiene, medical, or safety personnel of other Army installations. They included atmospheric samples of gases, vapors, and mists and bulk samples of liquids, solids, mixtures, and dust. The samples most often encountered included solvents, paints, lacquers, enamels, rust removers, paint removers, rustproofing compounds, soaps, detergents, greases, cutting oils, and metallic and siliceous dusts. More unusual samples included solid fuels, camouflage pastes, fungicidal compounds, artificial waxes, adhesive tape, and impregnated paper. Analysis of clinical specimens was done on only a few occasions in connection with certain investigations by the Medicine Section. As of 1 October 1945, a total of 5,806 samples had been submitted and analyzed. The proportion of samples sent in by members of the Industrial Hygiene Surveys Section to the total number in each successive 6-month period was 89, 80, 59, 46, 41, and 34 percent, respectively. These percentages reveal that the chemistry laboratory facilities were increasingly utilized by industrial hygiene and medical officers of the Army Air Forces, the service commands, and the individual Army installations, and they demonstrate also the value of maintaining such a laboratory.

Relatively few analyses were made for the Ordnance Department, because samples from ordnance installations were collected by the Army Industrial Hygiene Laboratory survey teams or by service command personnel and are listed under these categories. During the last two 6-month periods, the number of analyses made for the Ordnance Department was increased by submission of samples for the solvent index prepared by the Industrial Hygiene Branch, Safety and Security Division, Office of the Chief of Ordnance.

Laboratory field investigations carried out by personnel of the Chemistry Section included study of exposure to methyl bromide at ports of embarkation and exposures to acetylene tetrachloride, chlorine, phosgene, and hexachlorethane at Chemical Warfare Service plants.

Laboratory investigations were concerned almost entirely with improving or devising analytical and sampling procedures. The Wilson apparatus for determining atmospheric concentrations of chlorinated hydrocarbons was modified to increase its sensitivity to the point where it could be used in atmospheres contaminated by methyl bromide vapors in concentrations as low as 10 to 20 parts per million parts of air. Every important method of analysis in the list of standard analytic procedures used by this

section was investigated to establish whether its accuracy and sensitivity were adequate to determine the desired constituent in the amounts usually encountered.

Fungicide testing.—Early in 1945, a program was initiated whereby the percentage of fungicides present in samples of fabrics, leather, wood, and plastics submitted to the Army Industrial Hygiene Laboratory for toxicologic investigations was determined in this section. Previously, the percentage as stated by the manufacturer or as determined by other Government laboratories had been accepted. In fungicides containing a metal, such as copper or mercury, the amount of fungicide present was calculated from the amount of the metal found in the sample. In a fungicide without a metal but containing chlorine atoms (for example, dichlorodihydroxydiphenyl methane) the percentage was calculated on the basis of the organic chlorine content. A few other fungicides (for example, salicyl anilide) contained no metal nor chlorine, and the percentage of fungicide present was calculated on the “pickup” of the impregnating solution; that is, the amount of solution absorbed by the material impregnated.

While these methods of assay, coupled with mildew-resistance tests, might be adequate for determining conformance to specifications, they were not always adequate bases for correlating toxicologic data with analytic data. This was particularly true when mixtures of fungicides were used or when the impregnated material was leather. It was hoped that physical methods of analysis, such as use of ultraviolet and infrared absorption spectrophotometers, would prove satisfactory. A Beckmann ultraviolet spectrophotometer was obtained in May 1945, and a method of analysis for salicyl anilide in leather was worked out. Each procedure was an individual research problem and required considerable time for its consummation. Loss of qualified personnel after V-E Day interfered with the progress of this program, particularly in regard to light absorption techniques.

Gas chamber.—An important factor in the work on methods and techniques was the availability of an efficient gas chamber. This chamber, built according to specifications drawn up by the Army Industrial Hygiene Laboratory, was completed in August 1943. Its design proved so acceptable that in December 1944 a similar smaller gas chamber was constructed for use at the Fifth Echelon Repair Shop in the Medical Supply Depot, St. Louis, Mo.

Liaison.—Liaison between the Army Industrial Hygiene Laboratory and the branches of the Army requesting toxicologic evaluations was often unsatisfactory because of delay caused by communication through channels. Consequently, it was necessary to expedite the work by establishing direct liaison between this section and the Research and Development Division of each Army branch requesting such investigations, with confirmation through official channels.

During 1943, when dermatologic investigation was necessary, the actual testing was performed by the Dermatoses Investigations Section, Division of Industrial Hygiene, National Institute of Health. Early in 1944, it was decided that such investigations could be expedited if they were done by the Medicine Section of the Army Industrial Hygiene Laboratory. The National Institute of Health continued to cooperate actively in the investigations and remained the principal consultant in these matters. When animal experiments were necessary in making toxicologic evaluations, they were carried out by the Department of Pharmacology of the University of Maryland, since the Army Industrial Hygiene Laboratory had no facilities for this work. A separate contract was made for each series of experiments, and funds were authorized by the Surgeon General's Office. Since the number of investigations requiring animal studies was relatively small, contracting with an outside laboratory for this work was amply justified.

Data concerning the requests for toxicologic investigations from December 1942 to October 1945 are discussed under the "Medicine Section."

Special investigations.—Other special investigations were undertaken upon request of an Army industrial installation or were initiated by the Chemistry Section itself. Studies on chemical control of processes were initiated by the commanding officer of the laboratory in anticipation of future needs or were based upon direct inquiries from sources outside of the Army Industrial Hygiene Laboratory. The main purpose of these studies was to investigate chemical manufacturing processes, or those involving the handling of appreciable quantities of chemical compounds, to eliminate potential industrial health hazards.

It was believed during 1944 that this type of study might become a major function of this section. Accordingly, a Sanitary Corps officer with considerable experience in chemical industry was added to the staff. However, such projects were abandoned because experience showed that it was impossible in most cases to procure the detailed information necessary to make this type of study valuable. If the chemical operation was in a military installation, security regulations and the lack of a directive to insure cooperation hindered these studies. In commercial operations, the details of operation were closely guarded secrets and were not freely revealed. A complete list of special laboratory and field investigations conducted by the Chemistry Section is as follows:

1. Effects of toxic exposures as measured by the differential heat-sound meter.
2. Combustion products of solid fuels.
3. Determination of chlorinated hydrocarbon vapors in air.
4. Lead hazard associated with the use of field stoves and lanterns.
5. Decomposition products of XXCC-3.
6. Specifications for the purchase of protective creams and cleaners.
7. Analysis of fungicide-impregnated leather.

8. Rate of flow obtained through large impingers at various pressure drops.
9. Variations in rate of sampling by means of midget impingers.
10. Fire hazards associated with the handling of Navy strippable film.
11. Application of the Beckmann ultraviolet spectrophotometer to industrial hygiene analytic methods.
12. Standardization of industrial hygiene field equipment.
13. Characteristics of the halogenated hydrocarbon detector.
14. Fermentation process of manufacturing alcohol (Hiram Walker Co., Peoria, Ill.).
15. Manufacturing of butyl alcohol (Commercial Solvents Corp., Peoria, Ill.).
16. Processing of Atabrine, blood plasma, and penicillin (Abbott Chemical Co., Waukegan, Ill.).
17. Processing of Atabrine, blood plasma, and penicillin (Eli Lilly Chemical Co., Indianapolis, Ind.).
18. Manufacturing of DDT (Cincinnati Chemical Co., Cincinnati, Ohio).
19. Manufacturing of DDT (Merck Co., Rahway, N.J.).
20. Manufacturing of DDT (Hercules Powder Co., Wilmington, Del.).
21. Manufacturing of Atabrine tablets (Merrell Co., Cincinnati, Ohio).
22. Manufacturing of Atabrine intermediates (Hilton-Davis Co., Cincinnati, Ohio).
23. Fungusproofing and waterproofing of fabric webbing (Bridgeport Fabrics, Inc., Bridgeport, Conn.).
24. Dyeing, mildewproofing, and waterproofing of cotton yarns (American Thread Co., Willamantic, Conn.).
25. Fungusproofing and waterproofing of duck fabrics (Philadelphia Textile Finishers, Norristown, Pa.).
26. Mildewproofing of leather (Eastern Regional Laboratories, U.S. Department of Agriculture, Philadelphia, Pa.).

Personnel.—The personnel of the section spent approximately 33 percent of their time in analysis of samples, 29 percent in special investigations in the laboratory, 8 percent in special investigations in the field, 18 percent in research, 6 percent on the keeping of records, and 6 percent in calibration and repair of instruments. The growth of the Chemistry Section from a "staff" of one and no chemical facilities in 1942 to a staff of nine with a well-equipped laboratory at the end of the war resulted from an urgent need for the services of this section.

Evaluation.—In evaluating the accomplishments of the Chemistry Section, mistakes of commission and omission are apparent. The delayed organization of the section, without provision of adequate laboratory

facilities, showed a lack of perception of the problems of industrial hygiene in the Army. No organized or coordinated program was formulated under which the section could increase the scope of its activities.

Medicine Section

Mission.—The Medicine Section of the Army Industrial Hygiene Laboratory functioned as a consulting agency both to the other sections of the laboratory and to any Army headquarters or industrial installation which requested assistance in industrial health problems or toxicological evaluation of materials, chemical processes, or items of supply used or contemplated for use by the Army. In this capacity, it interpreted the physiologic effects of occupational health hazards, conducted special investigations regarding particular instances of disease or illness alleged to be associated with harmful working conditions, and assisted in performing the toxicologic studies carried on by the Occupational Health Division, Surgeon General's Office.

This section functioned with one Medical Corps officer, who was also the assistant director of the laboratory. The chief of the Medicine Section was aided by the commanding officer, Colonel Hussey, in collecting and dispersing data and information; he was assisted by the nonmedical officer and civilian personnel of the Army Industrial Hygiene Laboratory, and close cooperation existed between the Chemistry and Medicine Sections.

Activities.—The activities of the Medicine Section can be classified as follows:

1. Field investigations of instances of occupational illness in industrial installations.
2. Toxicologic evaluation of materials or chemical treatments or both in items of clothing and equipment used or proposed for use by military personnel.
3. Joint study with the Industrial Hygiene Surveys Section in evaluating industrial hazards to health in industrial installations.
4. Consideration of changes in processes or operations with the aim of minimizing or eliminating exposure to toxic materials.
5. Initiation of policies regarding new maximum allowable concentrations of atmospheric contaminants or those which were subject to question.
6. Special medical study in certain commercial plants supplying material to technical services.
7. Limited applied research in toxicology and methods of patch testing.

The toxicity studies, which represented the chief activity, were primarily concerned with evaluation of textiles treated with fungicides, insecticides for mites, insect repellents, and flame retardants. Nearly all other items fell into the general groups of solid fuels, cosmetics, plastics,

adhesives, chemicals, meals, alloys, and certain items of mechanical equipment.

The methods of evaluation included consultation, review of the literature, previous experience, laboratory research, animal experimentation, and dermatologic investigation by means of patch tests. This last method was used on about one-third of the items evaluated. The patch tests were usually performed on volunteer civilians by the Army Industrial Hygiene Laboratory in cooperation with the Dermatoses Investigations Section, U.S. Public Health Service, according to the procedure formulated by Schwartz and Peck.⁴⁴

Evaluation was requested on about 300 items. More than one-half of the requests were initiated by the Office of The Quartermaster General. Work was done for the following branches of the Army in decreasing order of volume: Corps of Engineers, Ordnance Department, Surgeon General's Office, Army Air Forces, Chemical Warfare Service, Signal Corps, service command headquarters, Transportation Corps, and Headquarters, Army Service Forces.

ARMORED MEDICAL RESEARCH LABORATORY

Historical Note⁴⁵

Even before the activation of the Armored Force on 10 July 1940, it was recognized that operators of armored vehicles were subject to unusual physical and mental stresses. Mechanization had increased in the armed services as well as in civilian life. It was clear that the extent and precise nature of the problems needed to be defined, measured, and studied. Conditions to be examined were not unlike those found in industrial situations among railway engineers, truckdrivers, riveters, and machinery operators. Since industrial medicine had already developed particular techniques for handling and measuring hazards and protecting personnel from the dangers of these conditions, it was logical that the experts in this field should be asked to concern themselves with the needs of the Armored Force.

Accordingly, early in 1941, the need for research facilities was referred to the Preventive Medicine Division, Surgeon General's Office, and to the National Research Council. In October 1941, the National Research Council's Committee on Industrial Medicine met with representatives of the Army, Navy, and U.S. Public Health Service.⁴⁶ The Army was represented by Colonel Simmons, Chief, Preventive Medicine Division, Surgeon General's Office; Col. (later Maj. Gen.) Albert W. Kenner, MC; Captain Warren; Captain Bedwell; Lt. Col. (later Col.) Cleon J. Gentzkow, MC; Maj. (later

⁴⁴ Schwartz, Louis, and Peck, Samuel M.: The Patch Test in Contact Dermatitis. Pub. Health Rep. 59: 546-557, 28 Apr. 1944.

⁴⁵ Annual Report, Armored Medical Research Laboratory, Fort Knox, Ky., 1943.

⁴⁶ Minutes, Meeting, Committee on Industrial Medicine, Division of Medical Sciences, National Research Council, 10 Oct. 1941, and 21 Jan. 1942.

Col.) Sam F. Seeley, MC, and Maj. Karl R. Lundeberg, MC. At this meeting, Colonel Kenner, Chief Surgeon, Armored Force, outlined some of the matters which needed investigation. These included: Removal of the injured, ventilation, carbon monoxide exposure, visual disturbances, flash, fatigue, postural hazards and injuries, head injuries, whipcord action on neck, tinnitus, rations, excessive temperature, dust, belt supports for back and trunk, sudden decompression, blasting effects of high explosives such as landmines, and the necessity for careful selection and elimination of those not physically or mentally suited to tank warfare. The creation of an experimental laboratory was discussed and a committee set up to explore the matter further. These efforts were brought to fruition when on 6 December 1941 the commanding general of the Armored Force, Maj. Gen. (later Lt. Gen.) Jacob L. Devers, requested the establishment of the laboratory. On 3 February 1942, the Secretary of War authorized its establishment at Fort Knox, Ky., headquarters of the Armored Force (fig. 28). Costs were estimated at \$220,000, without equipment and supplies, which, together with salaries, would be furnished through the Surgeon General's Office. Ground was broken on 12 March, and the building was accepted and occupied on 1 September 1942. During the building operation, the work of the laboratory had been begun and was carried on in temporary



FIGURE 28.—Main building, Armored Medical Research Laboratory, Fort Knox, Ky. (U.S. Army photograph.)

quarters. Useful information on temperatures, dust, and fatigue had been collected.

Function

In essence, the purpose of the laboratory was to study the soldier in relation to his duties in the Armored Force. The aim was to obtain basic data on selection and training of personnel and the performance of equipment. Conclusions could then be drawn to enable the individual man to perform his duties with maximum efficiency for the longest possible time and to determine the safe limits of personnel so that they could be known by commanders and tacticians. The laboratory was part of an enormous program, both civilian and military, which took a profound interest in the soldier in an endeavor to keep him healthy and efficient. The maximum mental and physical capacities were to be determined, and jobs and equipment were being planned around the individual rather than vice versa as had been done in the past.

Organization

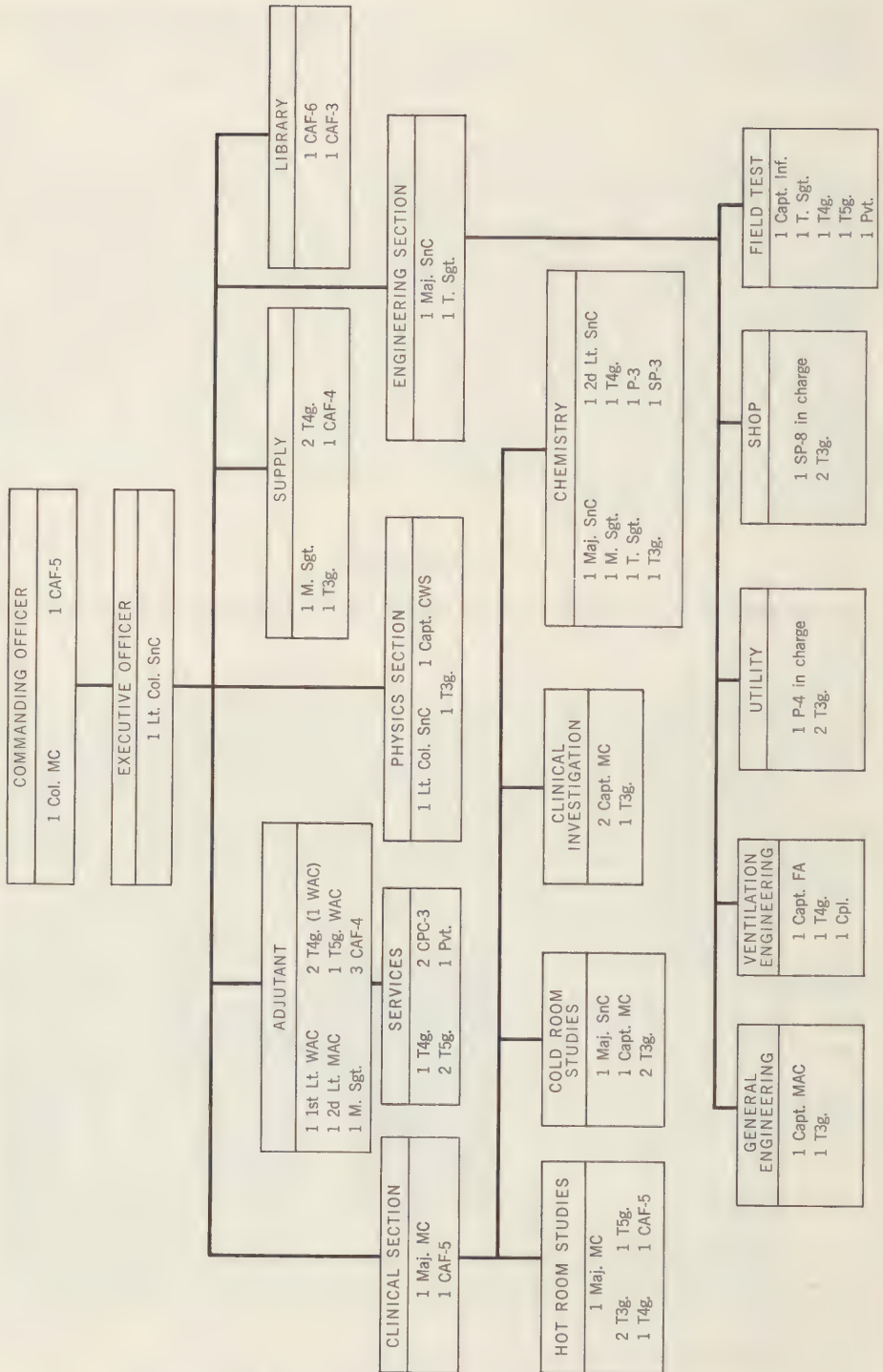
Since the purpose of the Armored Medical Research Laboratory was thus conceived of as being much broader than the field of medicine alone, other disciplines were combined in the organization. The laboratory was divided into the following seven sections: Administrative, Medicine, Physiology, Chemistry, Ventilation, Physics, and Engineering. The whole was under the direction of a medical officer, the commanding officer and the director of research. The organization was supported by liaison with The Surgeon General, the National Research Council, National Defense Research Committee, the Navy, Army Air Forces, and related investigative groups in Canada and England (chart 5).

The Armored Medical Research Laboratory was operated under control and supervision of the Commanding General, Army Ground Forces, Washington, D.C., from 1 September 1942 to 3 February 1944. On that date, pursuant to War Department Circular No. 98, dated 8 March 1944, the laboratory was transferred from the jurisdiction of the Army Ground Forces to that of the Army Service Forces and was designated a class IV installation under the control of the Occupational Health Division, Preventive Medicine Service, Surgeon General's Office.

Personnel

In April 1942, the Surgeon General's Office began recruiting from civilian sources specially trained men, all engaged in teaching or research. Since it was correctly anticipated that there would be a delay in obtaining commissions in the Army of the United States, provisions were made for personnel to obtain civil service appointments. The original staff of 10

CHART 5.—Table of Organization, Armored Medical Research Laboratory, 18 September 1945



officers included four doctors of medicine, four doctors of philosophy (two, physiology; one, physics; and one, chemistry), and two engineers. Dr. Willard F. Machle of the Kettering Laboratory, Cincinnati, Ohio, accepted the directorship; he later entered the service and took command with the grade of lieutenant colonel (later colonel), U.S. Army Medical Corps. Colonel Machle was in command until October 1945, when he was succeeded by Maj. William B. Bean, MC, who had been with the laboratory since August 1942.

Activities and Accomplishments

The activities of the laboratory frequently led to change in military doctrine and practice as well as in equipment. In general, the laboratory emphasized the fundamental importance of research in modern mechanized warfare and that man rather than the machine or weapon was frequently the limiting factor in combat. Only by improving the relationship of the soldier to his equipment and external environment was it possible for him to utilize the weapons and apparatus of destruction to greatest capacity. The following discussion considers the accomplishments of the laboratory in its main field of activity.

Studies in operations at high temperatures.—The majority of suggestions and recommendations from various reports on operations at high temperatures were accepted and embodied in Army doctrine. Since circular letters from the Surgeon General's Office which incorporated recommendations resulting from laboratory projects were not issued until July 1943, desert warfare was not affected, but desert training was made safer and performance was thereby improved. The conclusions on management of troops in relation to hot humid climate were generally known to medical officers in the Pacific theaters. Thus, principles of acclimatization, of water and salt needs, of tolerable limits of heat and humidity, of the effects of clothing, and of the importance of general hygiene were made known to responsible officers for their implementation (fig. 29).

Cold weather operations.—Because the laboratory's major mission was not that of testing equipment, much of the work in the coldroom was devoted to obtaining basic facts on man's response to cold environments. This inevitably included a consideration of clothing and its proper use. The high incidence of trenchfoot during the war indicated need for study of the provoking mechanisms. Close collaboration was maintained with the Office of The Quartermaster General and The Quartermaster General's Climatic Research Laboratory, Lawrence, Mass., on clothing study, and a number of projects were undertaken for the Office of The Quartermaster General. While many of the recommendations were not acted upon directly, they provided a point of departure for work by other agencies.



FIGURE 29.—Armored Medical Research Laboratory. Anteroom of high temperature psychometric room showing measurements being taken in skin temperatures of subjects working on a treadmill in the adjacent hotroom. (U.S. Army photograph.)

Rations.—Although the garrison ration was generally satisfactory throughout the war, much difficulty was encountered in the utilization of packaged field rations.

A critique of Army ration policy and feeding practices which pointed out theoretical shortcomings and faults detected in theaters of operations, the Canadian winter trials of 1944, and a short field test conducted by the Armored Medical Research Laboratory in 1942, led to a comprehensive field of study of emergency rations which was planned, executed, and reported by members of the laboratory staff in 1944. An entire infantry battalion undergoing rigorous training in an isolated area in Colorado was employed for the test of choice of ration, food consumption, and wastage. Physical fitness, medical and biochemical status, rifle firing scores, and officers' evaluation of subjects were used as criteria. The recommendations from the test resulted in great improvement of rations.

The field test was followed by a nutrition survey of troops in the Pacific which demonstrated that a small team with its own portable laboratory and equipment could operate effectively in a combat theater, and that the rations had all been improved to the point where they were accept-

able and adequate. It was also noted that the nutritional status and physical fitness of troops were excellent even in the Tropics.

Anthropometric and preselection studies.—It was apparent in the early days of the war that fitting the crew into the tank had been a consideration of less importance to tank designers than matters of armor, suspension, engine, and weapon. The result was not only inefficient operation, but also unnecessary hazard. Occupational injury in training was not unusual. By the compilation of data on measurements of representative soldiers, the laboratory defined certain parameters of the soldier population. The information collected was made available to the designers of equipment. Studies of the physical, physiologic, and psychologic requirements of tank crews were carried out with the formulation of basic principles for the selection of armored personnel.

Toxic gases in tanks.—Control of noxious gun fumes and gases in tanks was a problem of continued interest. Improvements in tank ventilation were developed for each new vehicle, and general principles were established for application to new design.

The major contribution of the laboratory to the solution of this problem consisted in quantitative approach where there had been much speculation and little fact. In association with the National Defense Research Committee, the Armored Medical Research Laboratory developed a device for instantaneous recording of gas levels which reduced the testing problem to one of reasonable simplicity.

Protection of tank crews against fires.—The sources of injury by fires in tanks included burning of stowed rounds after tank penetration, burning of fuel, or burning from hostile flamethrowers. Since the fire hazard added to the mental distress of combat, its effects were multiple. The laboratory investigation began with study of protective creams for preventing flash burns and of fire-resistant clothing. A corollary to this work consisted of extensive studies of the physiologic burden imposed by various types of fire-resisting impregnates in clothing worn in moist and dry heat and the best method of applying them in the field.

Vision and fire control.—While designers recognized that unsatisfactory mobility, armor, or firepower reduced the effectiveness of a tank, they were not wholly conversant with the limitations which the human factors in fire control placed upon its efficiency. Adequate facilities for fire control and general vision are of vital concern in tank design. The laboratory staff was able to revolutionize the primitive and inadequate instruments in use at the beginning of the war by instituting far-reaching changes, in consultation with the Armored Center (formerly the Armored Force), and the Ordnance Department. Basic principles were enunciated for the coordinated design of all instruments rather than the development of new instruments for every vehicle or gun.

The special field of night vision was also studied. Since the value of night operations was repeatedly demonstrated during the war, it was

necessary to know the natural limits of night vision, its variability in troops, and the methods whereby the soldier could learn to exploit to the fullest his potential capacity for night vision. Though the work originally was confined to the problems peculiar to the Armored Force, it was later expanded to include those of the entire Ground Forces, and collaboration with agencies working on the problem for the Army Air Forces and the Navy. A system of classification, selection, and training of personnel was formulated and put into practice. The basic influence of nocturnal visual capacity on new tactics was demonstrated, emphasizing such things as the value of binoculars and the use of red goggles to conserve dark adaptation within tanks.

Operations analysis.—Just as up-to-date job analysis was not employed by the peacetime Army, an objective critique of weapons and the mechanics of their employment by the soldier was never made. Analysis of the capabilities and limitations of various weapons systems was a continuing activity of the laboratory. An evaluation of fire from the moving tank when the gun was controlled by a gyro-stabilizer revealed deficiencies in design as well as a limitation of the maximum possible accuracy of moving fire due to the reaction time of the gunner.

Another laboratory study brought to light many correctable sources of error in existing artillery procedures and poor design of instrument scales. New instrument scales, designed and placed by the investigators according to sound industrial principles, effected a reduction in frequency of errors. These investigations showed that errors in gunnery as measures of the effectiveness of the weapons are capable of systematic study and quantitative measurement which permit objective comparison and evaluation.

Physiologic characteristics of new tanks.—Definition of the operational requirements of armored vehicles in terms of physiologic specifications was a basic contribution of the laboratory. As new tanks were developed, they were studied to see how well they fitted specifications and what modification was necessary.

Study of Atabrine administration.—A basic investigation of relationships between quantity and time of Atabrine ingestion and concentration and content of Atabrine in blood plasma was carried out on a large group of soldiers at the request of The Surgeon General. Though individual variability was great, group behavior followed definite laws which allowed the prediction of mean levels when dose and time of administration were known. These findings had wide implications in the field of chemotherapy. The practice of the Army in suppressive therapy was thereafter standardized on a sound basis.

Study in water purification.—An extensive and comprehensive investigation was made on the water purification agent Bursoline (diglycocol hydroiodide-iodine) with a limited group of test subjects for a 7-week period in the laboratory hotroom. During this time, working personnel

were subjected to tropical heat and high daily water requirements, while test concentrations of Bursoline were applied to all drinking water. No toxic effects were encountered, and it was recommended that Bursoline be considered safe for use as a water purification agent.

Dust.—The dust generated by armored vehicles operating in dry country is a great nuisance and causes some eye irritation. It was not regarded as a major problem by combat units, and therefore, did not receive the same attention as more important problems. Studies of dust concentrations, particle size, and mineralogical composition indicated that armored personnel were subjected to a negligible hazard of contracting silicosis. Studies on fenders and fins to reduce dust hazards were completed. An inexpensive expendable respirator was designed and adopted.

Noise and blast.—Audiograms of gunnery instructors revealed considerable loss in hearing after varying periods of exposure to gunblast. Audiograms repeated on the same subjects after several months without exposure to blast showed little improvement, while those who encountered gunblast repeatedly had further deterioration in hearing. Ear protectors were found to be valuable in reducing this effect, and the recommendation that those exposed frequently be provided with protectors was implemented.

Research in tank crew fatigue.—Physiologic studies included measurement of energy output required for various crew activities, physical fitness and methods for its evaluation, and effects of environment upon performance were carried out.

Human engineering.—Engineering studies, actually a matter of fitting the man into the tank, rather than the more logical procedure of building the tank around the structure and capacities of the man, included as follows: Design of most effective seats and hatchways, ammunition stowage, arrangement of control dials and levers, and elimination of unnecessary obstructive and dangerous excrescences. Measurement of work rates showed that weight, size, accessibility, and delivery point of ammunition rounds must be considered in tank design. By working directly with the Ordnance Department and seat manufacturers, laboratory recommendations could be implemented fully. Alterations in size and position of hatchways contributed to the peace of mind and safety of crews who were always sensitive to ease of escape from tanks. Many improvements and modifications which resulted from the collaborative efforts with the Armored Force Board and the Ordnance Department reflected the influence of the laboratory.

Protection of tank crews against chemical warfare agents.—Although gas warfare agents were not used in the war, it was necessary to have insurance against their possible employment by hostile forces. A series of studies on the protection of tank and crew from gas warfare agents established the following characteristics and limitations: Positive pressure ventilation of tanks, individual clean air supply to each crewmember, and use of the standard gas mask.

Evaluation of the Laboratory

Beginning without facilities for research and without precedent, the Armored Medical Research Laboratory had a staff functioning within 7 months of the outset of the war, was housed in its permanent building 2 months later, and before the end of the year, had completed and reported on a number of projects. Bringing together a small group of civilian scientists, it was able to apply the methods of modern scientific research to the problems of the individual soldier. At first, the efforts were focused on the interrelation of the man, his weapon, the tank, and the external environment. Very rapidly, the scope of work broadened to encompass acclimatization to heat, physical fitness, Atabrine metabolism, vision, fire control, nutrition, foot disabilities, burns, and many other problems.

The outstanding achievement of the laboratory was that it demonstrated to the Army the practicability of and necessity for research on the relationships of the soldier to his environments and to the weapons he uses. This was evidenced by the changes and improvements in weapons and vehicles which were made as the result of such research.

EVALUATION OF THE ARMY INDUSTRIAL MEDICAL PROGRAM

General Considerations

The Occupational Health Division comprised branches concerned with a variety of phases of medical science and was affiliated with agencies covering a broad field of medicine.

The Army industrial medical program had been developed and established between 1941 and 1945 and was accepted as a permanent part of Army procedure by Army Regulations No. 40-220, dated 16 October 1945. According to that regulation:

Civilian employees of War Department installations manufacturing, processing, storing, shipping or repairing supplies and equipment will be afforded an "on-the-job" medical and surgical service; they will be assured that they are physically fit for the job assigned, and that safe and hygienic working conditions will be maintained.

It further stated that The Surgeon General would (1) initiate policies, prepare directives, and give technical advice to all Army branches on matters pertaining to industrial health hazards and practices; (2) make such inspections, obtain such reports, and maintain such records as were necessary to assure the effectiveness of the program; and (3) maintain an industrial hygiene laboratory to conduct surveys and special investigations relative to the control of occupational health hazards and the improvement of working conditions and to conduct research in the field of industrial hygiene.

At the beginning of 1946, this program had arrived at the period of its development wherein the following minimum industrial medical service

was in effect: Every Army industrial installation had a physical plant and attendant personnel to render "on-the-job" medical and surgical service to civilian employees. Preplacement physical examinations were being conducted mainly by medical officers or civilian physicians assigned to the program. The means of securing hospitalization was available. Yearly industrial hygiene engineering surveys of all industrial plants were being made.

In many Army Service Forces and Army Air Forces industrial installations, the service rendered was more extensive and included routine chest X-ray survey of all employees, a program for women employees who became pregnant, general public health programs attacking absenteeism and dietary problems, periodic examinations of those workers employed in certain more hazardous operations, and an eye protection program, wherein safety glasses ground to prescription were made available.

The accomplishments of the program could best be measured by the "Quarterly Occupational Health Report," the one source of available information which accurately reflected the actual operation of the Army's industrial medical dispensaries. Data from these reports covering the periods April through June 1945 and July through September 1945 appear in table 8. The total number of employees is less than 800,000 estimated during the months of peak production, because these reports were not prepared until after V-E Day, and because they did not include Army Air Forces industrial installations, at which approximately 250,000 persons were employed.

Comparison With Private Industry

A comparison of the Army's industrial medical program with those previously established by private industry is of interest, for its policies and accomplishments stand up favorably when measured by contemporary standards. However, in any such comparison, it must be remembered that no single private industrial concern had as many employees, in as many different phases of industrial activity, spread over all the 48 States in installations of all sizes.

With respect to the personnel required for adequate plant medical service, the Army's requirements were in line with those proposed at a postgraduate course for industrial physicians held at the Long Island College of Medicine, N.Y., in November 1943.⁴⁷

Other civilian specialists in the field of industrial medicine recommended one doctor to 1,000 employees in small plants, and one doctor to between 2,400 and 3,000 employees in large plants. Various other recommended ratios of nurses to employees differed little from those in table 9.

That the Army was extremely economical in its use of doctors in the industrial medical program is suggested by the following data, based on

⁴⁷ Lectures and texts, Second Postgraduate Industrial Medical Course, Long Island College of Medicine, N.Y., 1-12 Nov. 1943.

TABLE 8.—*Statistical summary of "Quarterly Occupational Health Reports," for periods April-June and July-September 1945*

Industrial medical service	April- June 1945	July- September 1945
Installations reporting	173	194
Civilian employees	333,879	296,298
Medical Corps officers or physicians:		
Full time	213	249
Part time	79	88
Nurses:		
Full time	579	545
Part time	8	8
Industrial dispensaries	123	146
Industrial dispensary aid stations	185	194
Ambulances	186	232
Occupational illness:		
Cases	3,697	1,068
Treatments	5,496	2,286
Days lost	4,398	564
Occupational injury:		
Cases	79,656	79,897
Treatments	152,490	148,115
Nonoccupational illness and injury:		
Cases	197,970	244,861
Treatments	265,518	305,785
Days lost	551,779	574,817
Preventive medical activities:		
Preplacement examinations	44,127	46,665
Periodic examinations	19,950	26,174
Handicaps classified	3,398	3,037
Rejections	845	801
Serologic tests	35,668	35,081
X-rays of chest	24,249	25,632
Consultations	30,446	34,275
Immunizations	55,647	58,613
Occupational disease frequency	17.4	5.9
Occupational disease severity	.0211	.0031
Nonoccupational illness and injury frequency	952	1,358
Nonoccupational illness and injury severity	2.6	3.2
Nonoccupational illness and injury, cases per 1,000 employees per year	2.3	4.1
Applicants rejected, percentage	1.9	1.7
Employees per full-time doctor	1,590	1,190
Employees per total doctors	1,160	880
Employees per full-time nurses	585	544
Employees per total nurses	577	536
Treatments per month per full-time doctor	663	611
Preventive medical activity per month per full-time doctor	329	303
Total medical activity per month per full-time doctor	992	914

TABLE 9.—*Comparison of personnel requirements in the Army's industrial medical program with those proposed for private industry*

Number of employees	Proposed personnel	Army industrial medical program
250 or less	1 part-time doctor	1 part-time nurse
250-1,000	1 part-time doctor 1 full-time nurse	
1,000-2,500	1 full-time doctor 1-2 full-time nurses	Doctors: 1 : 1,590 Nurses: 1 : 579
2,500-5,000	2 full-time doctors 5 full-time nurses	

the "Quarterly Occupational Health Reports," for April through September 1945. Each full-time doctor averaged from 900 to 1,000 patients per month. The total number of visits to all industrial dispensaries (for treatment only) was approximately 3,834 per day for a plant population ranging between 300,000 and 333,000. This compares favorably with industry as a whole, for the standard rate for visits to the dispensary is considered to be 1 or 2 percent of the plant population per day.

The best industrial medical service according to one authority,⁴⁸ is achieved by meeting 12 criteria. Of the 12, 10 were already included in the Army industrial medical program (AR 40-220, 16 October 1945, and Army Service Forces Manual M210, March 1945). Items two and seven were not fully met.

1. A definitely organized plan for medical service.
2. A definitely designated staff of qualified physicians, surgeons, and attendants, with physician in charge of the service. (The rotation policy in the Army might well hinder such a proposal in peacetime and did affect the service during the war.)
3. Adequate emergency, dispensary, and hospital service.
4. Preemployment and periodic physical examinations made by qualified examiners.
5. Efficient care of all industrial injuries and occupational diseases.
6. Reasonable first aid and advice for employees suffering from non-industrial injuries and illness while on duty.
7. Education of the employee in accident prevention and personal hygiene. (This was done in some plants. The accident prevention program was coordinated with the safety program directed by the Office of The Provost Marshal General. The health education program was far better developed in the Army Air Forces than in Army Services Forces industrial installations.)

8. The elimination or control of all health hazards. (Recommendations were made in all plants when surveys were carried out.)

⁴⁸ Sapington, C. O.: *Essentials of Industrial Health*. Philadelphia: J. B. Lippincott Co., 1943.

9. Adequate medical records, including physical examination records, accessibly filed in the medical department under medical supervision.

10. Supervision of plant sanitation and all health measures for employees by the physician or surgeon in charge.

11. An ethical and cooperative relationship with the family physician.

12. The use of hospitals approved by the American College of Surgeons.

The same authority also cited the physical ratings of men employed by the Pullman Company in 1924 and 1940. The latter figures are compared here with the Army's experience in 1945, although the following limiting factors must be borne in mind: In 1945, the majority of the most physically fit men were in the Army, the age range of industrial employees was greater; and women were employed. Thus, in 1940, the Pullman Company had in its employ 8,225 men; and under the Army industrial medical program during April through June 1945, there were 44,127 men and women employed. The percentage of employees in good physical condition or with correctable defects which did not limit the ability to work was 94.89 percent for the Pullman Company as compared with 90.5 percent for the Army; employees physically handicapped who must be assigned specialized jobs and who required periodic physical checks was 5.52 percent as compared with 7.7 percent; and applicants rejected because of physical condition at time of preplacement examinations, 0.69 percent as compared with 1.8 percent for the Army.

The following statistics also show that the Army's general preventive medicine activities in industry compared favorably with those of any private industrial concern: Over a 6-month period in 1945, for a plant population of 296,298 to 333,879, there were 46,124 periodic examinations, 70,749 serologic examinations, 49,881 chest X-rays, 64,721 visits to the dispensary (classified as consultations for both occupational and nonoccupational illnesses and injuries), and 114,260 immunizations for smallpox, typhoid, paratyphoid fever, and tetanus.

Deficiencies

Most deficiencies in the operation of the Army industrial medical program were unavoidable. The program was not the same in every installation. The chief reason for the inconsistency stemmed from The Surgeon General's lack of operating jurisdiction, for he could only submit to higher authority proposals for general policy with respect to Medical Department activity. The commanding generals of the service commands, the Army Air Forces, and the Transportation Corps each had his own medical staff, which operated autonomously as long as it adhered to the basic principles of Medical Department activities. Under these circumstances, if a service command believed the industrial medical program was important, it was well organized and competently run, and advice was sought from the Surgeon

General's Office. However, a service command could keep industrial medicine in the background by following directives to a minimum, assigning a poor class of personnel to this work, and making replacements so frequently as to preclude the necessary orientation. This difference was apparent in the variation in reception granted visitors from the Surgeon General's Office, in the number of requests received for advice and engineering surveys, and in the knowledge of service command and post medical officers regarding problems in this field of medicine.

The Surgeon General's inability to exercise direct control of all Medical Department activities prevented the solution of problems at individual plants by issuance of letter orders. The Occupational Health Division could submit for issue only those directives which were for Army-wide distribution. Because of this limitation, every directive had to be workable in all plants, and many a small industrial medical service was incapable of carrying out improvements in the program which could be undertaken easily by a large dispensary. Without jurisdiction over industrial plants, the Occupational Health Division could not assist in the individual problems of an industrial medical officer beyond discussing the difficulties with the commanding officer and urging all possible improvements in the program.

Another deficiency in the program was associated with the variations in plant size (they ranged from 100 to 28,000 employees). In large installations, it was relatively simple to create an efficient industrial medical service with full-time personnel and adequate equipment to render extensive care for the employees. The commanders of these installations were of necessity excellent administrators. The efficiency of their employees was of concern to them, and they readily appreciated that the industrial medical department could supply data showing how it assisted in producing more per man, moving more per man, and cutting down absenteeism and labor turnover.

In the small- and medium-size plants, the program was apt to contrast unfavorably with that in larger organizations, because the medical officer was usually supplanted by a part-time or full-time civilian doctor whose primary interests often lay outside industrial medicine. Although there were notable exceptions, a number of these physicians lacked training in industrial medicine and sufficient knowledge of industrial operations. This resulted in their inability to evaluate the physical and mental requirements of each job to assign an applicant within his capacity and determine his fitness to return to work after injury or illness, to prescribe when and on which employees periodic examinations should be made, or to recognize working conditions which were detrimental to health. An industrial medical service staffed only by a part-time doctor was often at a disadvantage, because constant checking and medical supervision were required.

A third deficiency lay in the inadequacy of reports received in the Surgeon General's Office from which the cost of the industrial medical program could be estimated. The cost of erection of dispensaries and aid

stations was most difficult to obtain and was unknown to The Surgeon General. The cost of doctors could not be estimated because of the high percentage of medical officers who might well be in a different income bracket if not in uniform. The maintenance costs of industrial dispensaries and aid stations could not be calculated, since this item was included in the overall post cost.

Until early in 1946, there were two serious omissions in the industrial medical programs of both the Army and private concerns. The first was the failure on the part of industrial medicine to demonstrate how its program might be financially profitable to industry. Industrial medicine in the past seems to have based its right to existence upon compensation laws. Few, if any, facts and figures were available without the assumption of so-called hidden benefits to show that industrial medicine was operating to the profit of industry. According to Brundage,⁴⁹ the dollar sign should not be used as the only measure of the value of an industrial medical service. However, unless a yardstick of advantages and disadvantages is established, weak points in such a program do not become apparent, and overemphasis on certain phases is not discovered. Filene⁵⁰ shows the importance of finding out how much sickness there is in an organization and then deciding what can be done about it. If an organization does more than it can afford to do for its employees he points out, some other organization which does not do so much will undersell it, and presently, there will be no business and no resources with which to do anything. It is, therefore, necessary for a company to confine itself to some course which will be good for the business and by which it can continue to operate.

By properly placing men in jobs they can and like to do, turnover will be less, absenteeism will be reduced, and production will be cheaper. By knowing what causes people to be away from the job, the problem can be best attacked, and by recognizing and correcting the situations which are unhealthy and not conducive to good work, efficiency can be increased. The result is that a smaller number of employees can do the same amount of work. By knowing past costs and keeping records of current ones, an estimate can be made of the efficiency of the service. If a profit cannot be shown, a new approach to the problem can be made. The Army's industrial medical program, by the end of the war, had all the tools to accomplish these ends.

The second defect in industrial medical programs was failure to realize that emphasis should be shifted from toxicology to job placement. The first approach to industrial medical problems was of necessity from the standpoint of the toxic hazards involved and such hazards were always given primary place in industrial preventive medicine, even though these prob-

⁴⁹ Brundage, Dean K.: *An Estimate of the Monetary Value to Industry of Plant Medical and Safety Services*. Pub. Health Rep. 51: 1145-1159, 21 Aug. 1936.

⁵⁰ Filene, Edward A.: *How I Got That Way*. The Survey Graphic 23 (12), December 1934.

lems can be and usually are handled chiefly by chemists, pharmacologists, and industrial hygiene engineers. It became evident that attention should be focused on research in the study of what a human being is capable of doing under the varying conditions and environment of his assigned task.

Too little was known concerning this large and complex subject, which includes consideration of the physical, mental, emotional, and psychological components of the human makeup and how they are influenced by the environment, the assigned task, the "boss," and the entire plant. That the Army had taken a first step toward overcoming this deficiency of its industrial medical program is evident in its formulation and use of WD Form 91, dated 22 March 1945, entitled "Physical Qualification Placement Record."

Conclusion

The Occupational Health Division was disbanded on 1 October 1945; its activities and functions were transferred to the Army Industrial Hygiene Laboratory, which was to be reestablished at the Army Chemical Center, Edgewood Arsenal, Md.

It was clear that the industrial medical program had more than justified its existence and that it was now firmly established among Army medical activities. There were matters which needed further clarification, such as the extent of toxicological research which should be undertaken by the Army. The conclusion of the war suggested an occasion for reassessment of War Department technical bulletins, manuals, and circulars, as well as for wider orientation of new officers into the field of industrial medicine and hygiene engineering. Another opportunity was presented in the "Quarterly Occupational Health Reports" for study of more factual data than had been obtained previously. Continued and closer liaison between the Army Industrial Hygiene Laboratory and the Armored Medical Research Laboratory were recommended by the retiring director. It was believed that the Army Industrial Hygiene Laboratory would be able to make even more significant contributions in the future to the safety and hygiene standards of the War Department installations, in the making of surveys and maintenance of continuous records as well as in the handling of engineering and other types of research in this important field.

CHAPTER IV

Disabilities Due To Environmental and Climatic Factors

Constantin P. Yaglou, M.M.E.,¹ and William L. Hawley, M.D.

Part I. Heat Trauma

Constantin P. Yaglou, M.M.E.

The experiences of the U.S. Army in World War I with environmental heat were not sufficiently significant to be recorded in the histories as a warning for future wars. The temperate climate of Europe presented fewer heat problems than that of the United States itself. World War II had barely begun before the Army was faced with the need to operate in extremes of both hot and cold temperatures. As the areas of warfare extended, the size of the Army had to be increased. Many training centers were located in the South and in the West, so that both at home and abroad the Medical Department was made aware of the hazards involved in exposing large numbers of men to excessive heat.

In the war years 1942-45, there were 35,398 admissions to hospitals and quarters for heat effects, with 238 deaths, in the total U.S. Army, according to presently available statistical data,² excluding admissions and deaths caused by sunburn or burns. The annual admission rate per 1,000 mean strength was 1.38 in World War II, compared with 1.00 in World War I which was fought largely in the temperate climate of Europe. The average time lost owing to heat trauma was approximately 5.3 days per admission in World War II, compared with 6.0 days in World War I. The average daily noneffective rate was 0.02 per 1,000 in both wars. This means that only one man of every 50,000 men in the total Army was absent from duty every day of the war because of heat injury, excluding sunburn and burns.

Although these data underestimate the heat morbidity by taking into account only persons absent from duty, it is evident that insofar as the overall war effort was concerned, heat trauma played only a minor role, except in hot regions and for limited periods. Most of the U.S. troop activity was conducted in temperate or semitropical areas, and the low admission rates from these areas greatly diluted the high rates from hot regions, where relatively small forces were involved.

¹ Professor Yaglou died on 2 June 1960, shortly after writing this section.—E. C. H.

² Unless otherwise indicated, the statistical analysis of the ill effects of heat in the U.S. Army in World War II is based on data compiled by the Medical Statistics Division, Office of The Surgeon General, Department of the Army.

Review of World War II experience by geographic area and by season of the year shows that heat trauma was indeed a serious medical and tactical problem in the Persian Gulf Command and in the India-Burma theater during the summer months of 1942 and 1943. After this period, the seasoning of troops and the use of preventive measures greatly reduced the incidence, but even under the best controlled conditions heat morbidity in these two hottest regions of the world remained significantly higher than the average for all theaters throughout the war.

A critical study of preventive measures used late in World War II discloses that there were few of the basic facts which were not actually known at the beginning of hostilities. The mistake lay in failure to apply them. The principal reasons for not taking full advantage of demonstrably useful preventive measures early in the war were subordination of preventive measures to purely military considerations, unwillingness by commanding officers to accept medical advice, loss of experienced officers between wars, and inadequate indoctrination of officers and men in the principles of prevention. Review of World War II experience with heat trauma should help in preventing a repetition of past mistakes.

DISTRIBUTION OF HEAT CASUALTIES BY TRAUMATIC GROUP

Precise classification of the effects of excessive heat on man is difficult, not only because the wide range in severity of symptoms confuses diagnosis, but also because the nomenclature differs considerably. Three categories are generally recognized: heat exhaustion, heat stroke, and heat cramps.

Heat exhaustion.—Characterized by symptoms of lassitude, headache, nausea, mild cramps, dizziness, and, finally, collapse, heat exhaustion was the most frequent cause of disability owing to effects of heat; it accounted for one-half or more of all heat cases admitted to hospitals and quarters (table 10). The full impact of heat as evidenced by this disorder was not determined because many men were not incapacitated to the extent of being excused from duty, and therefore their numbers were not recorded in sick lists. The annual admission rate for heat exhaustion in the total Army was 0.71 per 1,000, and the case fatality rate was 0.20 percent.

Heat stroke.—High body temperature (greater than 105°), hot dry skin, and eventual unconsciousness are the usual features of heat stroke, which accounted for only 5 percent of the heat cases admitted, but was responsible for about 70 percent of the deaths caused by environmental heat in the total Army. The annual admission rate for heat stroke was only 0.07 per 1,000 troop strength, but the case fatality rate was as high as 10.23 percent (table 10). Although admissions for heat stroke generally reflected the true incidence of this disease, cases were reported in some overseas regions early in the war in which the differential diagnosis, particularly with malaria, was difficult until the use of malaria smears became a routine differential diagnostic procedure.

TABLE 10.—Admissions to hospital and quarters, and deaths, from effects of heat (excluding sunburn and burns), in the U.S. Army, by traumatic group and by area of admission, 1942-45

[Preliminary data based on sample tabulations of individual medical records]

[Admission rate expressed as number per annum per 1,000 average strength]

[Death rate expressed as number per annum per 100,000 average strength]

Traumatic group	Total Army		Continental United States		Total outside continental United States	
	Number	Rate	Number	Rate	Number	Rate
Admissions						
Heat exhaustion	17,971	0.71	11,735	0.80	6,236	0.59
Heat stroke.....	1,661	.07	1,298	.09	263	.03
Other effects of heat.....	15,766	.60	13,903	.94	1,863	.17
Total.....	35,398	1.38	26,936	1.83	8,462	0.79
Deaths						
Heat exhaustion	36	0.20	25	0.21	11	0.18
Heat stroke.....	170	10.23	153	11.80	17	4.68
Other effects of heat.....	32	.20	24	.17	8	.43
Total.....	238	0.67	202	0.75	36	0.43

Source: Memorandum, Chief, Medical Statistics Division, Office of The Surgeon General, Department of the Army, for Editor-in-Chief, Historical Unit, AMS, 22 Sept. 1953, subject: Adverse Effects of Heat During World War II. Inclosures thereto, tables dated 28 Aug. 1953.

Heat cramps.—Manifested by painful muscle spasms due to excessive loss of body salt, heat cramps were rare as a clinical entity, and the few serious cases presumably were included in the miscellaneous classification of “other effects of heat” in table 10.

Heat rash (prickly heat; miliaria).—Although rampant among U.S. troops in all hot-humid areas, prickly heat accounted for relatively few admissions. They were also grouped under “other effects of heat” in table 10. The cases admitted presumably were either wholly or partially disabled.

Other effects of heat.—In addition to prickly heat and heat cramps, there are various ill-defined heat effects, such as general weakness, fatigue, nausea, and headache. Approximately 45 percent of the men admitted for heat injury had suffered from these symptoms (table 10). However, because of inadequate diagnostic criteria, no great reliance can be placed on these figures. It is most likely that these injuries were actually cases of heat exhaustion which had escaped diagnosis. Moreover, it should not be inferred that all of them were mild, for many progressed to the crucial stage as is shown by the fatality rate that was as high as that of the originally diagnosed heat exhaustion cases (table 10). This concept of the gradient of severity of heat trauma was clearly brought out by experience in the Persian Gulf Command, which showed that all heat cases, no matter how

mild, were potentially dangerous and required prompt and continued medical care until recovery was assured.³

Sunburn.—Sunburn, while not generally considered to be heat trauma in the sense of severe constitutional or physical disorder, deserves serious consideration because of its high prevalence and the resulting loss of time and efficiency. Acute sunburn impairs sweating in affected areas, interferes with sleep, and may predispose the victim to heat exhaustion and heat stroke.

In World War II, 14,903 cases of sunburn were admitted for medical treatment: 11,225 cases in the continental United States and 3,678 in overseas theaters.⁴ Although only one man died of sunburn, the average time lost per admission was 5 days, nearly as much as the average (5.3 days) for all heat cases in the Army.

GEOGRAPHIC AND SEASONAL DISTRIBUTION OF HEAT TRAUMA

As expected, admission rates for heat effects depended largely on the climate, season, and activity of troops. In the theaters of North America, Europe, the Mediterranean, and Latin America, the morbidity from heat among U.S. troops remained low throughout the war. In all other theaters, the incidence increased during the summer months and at times reached epidemic proportions, even in the Zone of Interior, where there were many casualties at such training centers as Fort Lee and Fort Eustis in Virginia. It should be noted in this connection, however, that the annual admission rates cover the cool as well as the hot months and frequently involve large areas which may include pockets of extremely hot weather. Theater statistics may therefore not always reflect a true picture of the magnitude of the problems of heat trauma in every locality (tables 11, 12, 13, and 14).

Middle East Theater.—Heat trauma was a major problem in the Middle East Theater from May to September 1943, especially in Iran and Eritrea (map 1). The annual admission rate for the whole theater in 1943 was 20.80 per 1,000 mean strength, with a maximum of 88.59 in August (table 13). In 1944, the annual rate decreased to 3.41 per 1,000, with a maximum of 15.76 in July (table 14). These rates for the whole theater do not fully reflect the magnitude of the heat problem, because low rates from relatively cool regions of this theater greatly diluted the high rates from the Persian Gulf Command, where most heat casualties occurred. A review of the outstanding experience of this command follows.

Persian Gulf Command (Iran).—American service troops, composed of supply and transportation personnel, arrived in this hottest region of the world in the latter half of 1942 and the first half of 1943, for the purpose of moving war materials from Persian Gulf ports through Iran to Russia.

³ Report, Office of the Chief, Medical Branch, Supply Division, Headquarters, Persian Gulf Command, to The Surgeon General, 14 Feb. 1945, subject: Medical History, Persian Gulf Command, 1944, pp. 12-13.

⁴ See footnote 2, p. 203.

TABLE 11.—Admissions for effects of heat (excluding sunburn and burns), total U.S. Army, by theater and year, 1942-45

[Preliminary data based on sample tabulations of individual medical records]

[Rate expressed as number per annum per 1,000 average strength]

Theater or area	Total		1942		1943		1944		1945	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
All theaters and areas.....	35,398	1.38	6,579	2.03	17,408	2.54	6,941	0.89	4,470	0.59
Continental										
United States.....	26,936	1.83	5,852	2.20	14,470	2.79	4,299	1.08	2,315	.79
Total outside continental										
United States ¹	8,462	.79	727	1.24	2,938	1.74	2,642	.69	2,155	.46
Europe.....	231	.05	4	.05	8	.03	79	.04	140	.06
Mediterranean ²	987	.67	2	.09	716	1.57	204	.31	65	.18
Middle East.....	1,377	9.42	35	5.78	1,104	20.82	158	3.41	80	1.96
China-Burma-India.....	949	2.16	92	10.52	92	2.32	525	3.11	240	1.08
Southwest Pacific.....	2,891	1.58	122	1.72	386	2.03	1,148	2.13	1,235	1.20
Central and South Pacific.....	1,238	.98	174	1.15	460	1.58	399	.91	205	.54
North America ³	26	.05	8	.08	4	.02	4	.03	10	.15
Latin America.....	252	.66	114	1.12	97	.80	31	.36	10	.14

¹ Includes admissions on transports.

² Includes North Africa.

³ Includes Alaska and Iceland.

Source: Memorandum, Chief, Medical Statistics Division, Office of The Surgeon General, Department of the Army, for Director, Historical Unit, AMEDS, 6 Dec. 1956, subject: Adverse Effects of Heat During World War II. Inclosure thereto, table dated 3 Dec. 1956.

TABLE 12.—Admissions for effects of heat (excluding sunburn and burns), in the U.S. Army, by theater or area and month, 1942

[Preliminary data based on sample tabulations of individual medical records]

[Rate expressed as number of admissions per annum per 1,000 average strength]

Theater or area	Total		January		February		March		April	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Continental United States.....	5,852	2.20	4	0.03	2	0.01	16	0.10	47	0.27
Overseas:										
Europe.....	4	0.05								
Mediterranean ¹	2	.09	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Middle East.....	35	5.78	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
China-Burma-India.....	92	10.52	(²)	(²)	(²)	(²)	2	7.55		
Southwest Pacific.....	122	1.72	2	6.38	2	3.64	5	2.95	1	.24
Central and South Pacific.....	174	1.15	2	.43	4	.85	21	3.41	15	1.60
North America ³	8	.08								
Latin America.....	114	1.12	6	.99	10	1.60	15	2.03	13	1.54
Total overseas ⁴	727	1.24	15	0.94	29	1.55	59	2.34	31	0.95
Total Army.....	6,579	2.03	19	0.13	31	0.20	75	0.40	78	0.38

See footnotes at end of table.

TABLE 12.—Admissions for effects of heat (excluding sunburn and burns), in the U.S. Army, by theater or area and month, 1942—Continued

Theater or area	May		June		July		August	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Continental United States	248	1.30	822	4.13	2,693	12.49	1,352	5.80
Overseas:								
Europe							4	0.40
Mediterranean ¹	(²)	(²)	(²)	(²)	(²)	(²)	(²)	(²)
Middle East	(²)	(²)	1	22.22	3	9.52	7	15.02
China-Burma-India	6	10.97	40	70.80	30	42.86	8	8.71
Southwest Pacific	1	.17	3	.44	1	.13	7	.83
Central and								
South Pacific	10	.88	19	1.49	11	.75	10	.66
North America ³					7	.72	1	.09
Latin America	7	.86	5	.58	7	.75	4	.43
Total overseas ⁴	152	3.92	72	1.64	59	1.15	41	0.70
Total Army	400	1.74	894	3.69	2,752	10.32	1,393	4.78
Theater or area	September		October		November		December	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Continental United States	569	2.29	70	0.25	18	0.06	11	0.03
Overseas:								
Europe								
Mediterranean ¹	(²)	(²)	(²)	(²)			2	0.13
Middle East	11	15.45	4	4.66	7	4.58	2	.94
China-Burma-India	2	1.77	4	2.66				
Southwest Pacific	8	.97	15	1.62	22	2.52	55	5.85
Central and								
South Pacific	10	.62	7	.40	20	1.09	45	2.23
North America ³								
Latin America	15	1.60	11	1.16	9	.96	12	1.18
Total overseas ⁴	53	0.85	42	0.59	58	0.72	116	1.33
Total Army	622	2.00	112	0.31	76	0.20	127	0.28

¹ Includes North Africa.² Few or no troops in theater.³ Includes Alaska and Iceland.⁴ Includes admissions on transports.

The men were exposed to the hot-moist climate of the Gulf region, the desert climate in the interior of Iran, and the relatively pleasant mountainous climate of Teheran (map 2). From June to September, daytime shade temperatures ranged from 90° to 115° F. in the coastal Gulf area and from 100° to 130° F. in the desert. Temperatures recorded inside tents, closed vehicles, and railroad cars often were many degrees higher. The

TABLE 13.—*Admissions for effects of heat (excluding sunburn and burns), in the U.S. Army, by theater or area and month, 1943*¹

[Preliminary data based on sample tabulations of individual medical records]

[Rate expressed as number of admissions per annum per 1,000 average strength]

Theater or area	Total		January		February		March		April	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Continental United States	14,470	2.79	20	0.05	40	0.10	30	0.07	180	0.41
Overseas :										
Europe	8	0.03								
Mediterranean ²	713	1.56	1	0.05					12	0.41
Middle East	1,103	20.80	2	.73			6	1.43	5	1.15
China-Burma-India	92	2.32			1	0.66	2	1.08	1	.44
Southwest Pacific	386	2.03	31	3.36	33	3.59	30	2.69	18	1.57
Central and										
South Pacific	460	1.58	57	2.80	59	3.25	30	1.46	27	1.31
North America ³	4	.02								
Latin America	97	.80	16	1.48	8	.82	12	1.13	7	.69
Total overseas ⁴	2,934	1.74	107	1.13	113	1.29	80	0.77	70	0.65
Total Army	17,404	2.54	127	0.26	153	0.33	110	0.20	250	0.46
Theater or area			May		June		July		August	
			Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Continental United States			805	1.75	3,250	7.28	5,165	11.15	4,080	8.92
Overseas :										
Europe							2	0.11	3	0.14
Mediterranean ²			62	1.67	140	3.63	251	5.84	152	3.42
Middle East			72	15.41	83	17.30	323	57.45	495	88.59
China-Burma-India			24	8.91	17	6.56	17	6.18	5	1.57
Southwest Pacific			13	1.02	7	.50	15	.93	23	1.28
Central and										
South Pacific			28	1.23	6	.26	26	1.00	17	.68
North America ³			1				3	.15		
Latin America			4	.37	6	.60	11	1.06	10	.96
Total overseas ⁴			219	1.76	263	2.06	661	4.45	719	4.61
Total Army			1,024	1.76	3,513	6.12	5,826	9.52	4,799	7.82

See footnotes at end of table.

relative humidity ranged from as high as 90 percent in the southern coastal areas to as low as from 5 to 20 percent in the desert. A few miles inland from the coast, the daytime relative humidity in the summer remained at 20 to 25 percent.

Heat trauma exacted a higher toll from personnel of this command than from any other American command in World War II. During the first 7 months of operations in Iran (June–December 1942), when the strength was not much more than 1,000 men, heat trauma was second

TABLE 13.—Admissions for effects of heat (excluding sunburn and burns), in the U.S. Army, by theater or area and month, 1943¹—Continued

Theater or area	September		October		November		December	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Continental United States	800	1.83	70	0.16	5	0.01	25	0.06
Overseas:								
Europe	2	0.08			1	0.02		
Mediterranean ²	91	1.95	3	0.06			1	0.02
Middle East	106	21.91	11	2.40				
China-Burma-India	19	4.80	3	.62	3	.50		
Southwest Pacific	23	1.20	59	2.75	57	2.58	77	3.04
Central and South Pacific	79	3.07	39	1.37	43	1.48	49	1.55
North America ³								
Latin America	5	.50	10	1.02	5	.52	3	.34
Total overseas ⁴	331	2.07	128	0.72	113	0.61	130	0.61
Total Army	1,131	1.89	198	0.32	118	0.19	155	0.24

¹ Excludes 4 admissions categorized as battle injuries, for which the monthly distribution is not available.² Includes North Africa.³ Includes Alaska and Iceland.⁴ Includes 71 admissions on transports.

Source: Memorandum, Chief, Medical Statistics Division, Office of The Surgeon General, Department of the Army, for Director, Historical Unit, AMEDS, 6 Dec. 1956, subject: Adverse Effects of Heat During World War II. Inclosure thereto, table dated 3 Dec. 1956.

TABLE 14.—Admissions for effects of heat (excluding sunburn and burns), in the U.S. Army, by theater or area and month, 1944¹

[Preliminary data based on sample tabulations of individual medical records]

[Rate expressed as number of admissions per annum per 1,000 average strength]

Theater or area	Total		January		February		March		April	
	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate	Num-ber	Rate
Continental United States	4,299	1.08	4	0.01	18	0.05	23	0.06	53	0.14
Overseas:										
Europe	75	0.04					5	0.05	5	0.05
Mediterranean ²	196	.30	1	0.02	3	0.06	3	.06	4	.07
Middle East	158	3.41	5	1.20	1	.26			5	1.37
China-Burma-India	525	3.11					4	.40	30	2.77
Southwest Pacific	1,061	1.97	85	3.21	73	2.59	81	2.49	72	1.97
Central and South Pacific	391	.89	48	1.48	25	.73	34	.89	23	.59
North America ³	4	.03								
Latin America	31	.36	6	.72	4	.53	3	.37	1	.13
Total overseas ⁴	2,535	0.67	151	0.66	123	0.53	136	0.52	146	0.52
Total Army	6,834	0.88	155	0.24	141	0.24	159	0.25	199	0.31

See footnotes at end of table.

TABLE 14.—*Admissions for effects of heat (excluding sunburn and burns), in the U.S. Army, by theater or area and month, 1944*¹—Continued

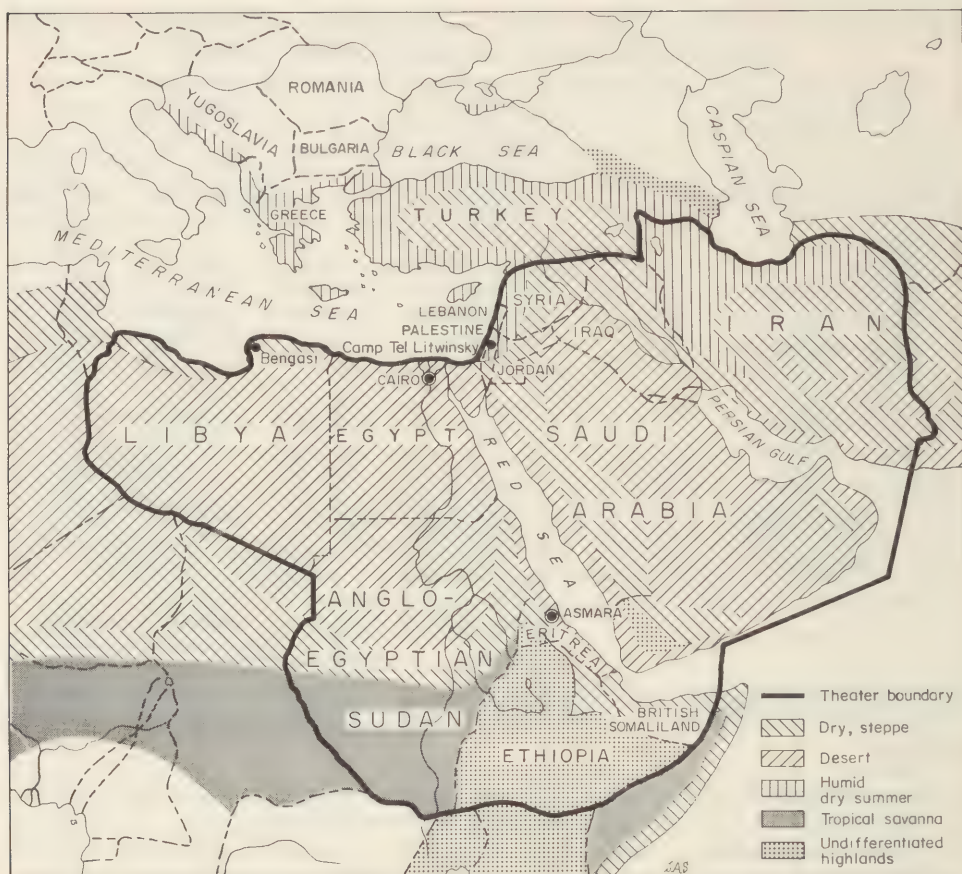
Theater or area	May		June		July		August	
	Num- ber	Rate	Num- ber	Rate	Num- ber	Rate	Num- ber	Rate
Continental United States	370	1.04	1,200	3.58	1,296	3.82	932	2.84
Overseas:								
Europe	15	0.12			15	0.11	30	0.19
Mediterranean ²	14	.23	37	0.64	71	1.19	55	.97
Middle East	11	3.02	58	15.76	56	14.37	19	4.87
China-Burma-India	184	13.31	185	13.21	55	3.57	45	2.79
Southwest Pacific	101	2.40	94	2.17	51	1.03	55	1.08
Central and								
South Pacific	29	.74	63	1.64	39	1.05	27	.70
North America ³			3	.28	1	.10		
Latin America	1	.13	5	.72	1	.14	1	.15
Total overseas ⁴	366	1.19	449	1.45	300	0.89	244	0.71
Total Army	736	1.11	1,649	2.55	1,596	2.36	1,176	1.75

Theater or area	September		October		November		December	
	Num- ber	Rate	Num- ber	Rate	Num- ber	Rate	Num- ber	Rate
Continental United States	386	1.27	13	0.05	4	0.01		
Overseas:								
Europe	5	0.03						
Mediterranean ²	2	.04	6	0.11				
Middle East	1	.27	2	.49				
China-Burma-India	11	.67	5	.28	3	0.17	3	0.15
Southwest Pacific	66	1.28	202	3.54	118	1.99	63	1.01
Central and								
South Pacific	27	.71	25	.68	25	.75	26	.80
North America ³								
Latin America	4	.62	4	.60			1	.15
Total overseas ⁴	122	0.35	248	0.66	151	0.40	99	0.25
Total Army	508	0.78	261	0.39	155	0.23	99	0.15

¹ Excludes 107 admissions categorized as battle injuries, for which the monthly distribution is not available.² Includes North Africa.³ Includes Alaska and Iceland.⁴ Includes 94 admissions on transports.

Source: Memorandum, Chief, Medical Statistics Division, Office of The Surgeon General, Department of the Army, for Director, Historical Unit, AMEDS, 6 Dec. 1956, subject: Adverse Effects of Heat During World War II. Inclosure thereto, table dated 3 Dec. 1956.

only to enteritis as a cause of admission to the first American hospital at Ahwaz (unnumbered at that time, but designated the 2d Station Hospital on 1 January 1943 and redesignated the 256th Station hospital on 31 January 1943). A total of 115 cases of heat stroke (11.7 percent of admissions for all causes) were treated successfully and without a death during the



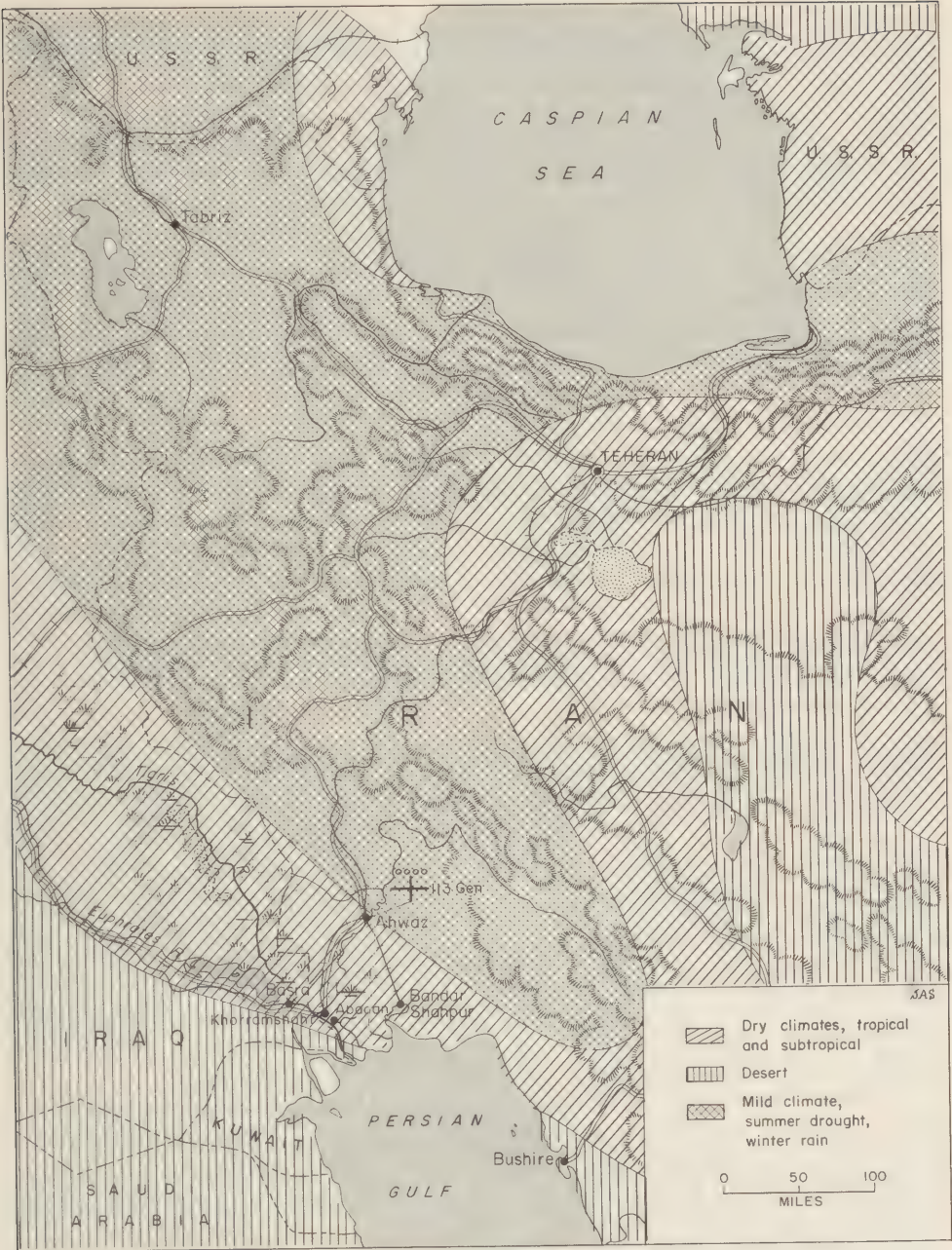
MAP 1.—Middle East Theater, May–September 1943.

7-month period. Numerous other less severe cases received treatment at dispensaries.⁵

A comparative study of distribution of heat effects in the Persian Gulf Command, by climatic region, traumatic group, and race, was made by Lt. Col. A. A. Carabelli, MC, Medical Consultant to the command.⁶ His original data, although still not verified in official records, form the basis for ample comparison of the effects of heat trauma by type in white and Negro troops in differing environments in the theater (table 15). In the mountain district of Teheran, heat was clearly no problem. It was in the desert and the Gulf regions that the heat cases occurred. The climax was reached in the desert in July 1943, when the total heat morbidity

⁵ A Narrative History of Medical Activities in the Persian Gulf Command. Prepared by the Historical Section, Office of Technical Information, Headquarters, Persian Gulf Command, pp. 3, 4, and 31.

⁶ Report, Office of the Assistant Chief of Staff for Supply, Headquarters, Persian Gulf Command, to Commanding General, Gulf District, 25 May 1944, subject: Casualties From the Ill-Effects of Heat, appendix No. 9.



MAP 2.—Persian Gulf area.

TABLE 15.—*Casualty rates from the ill-effects of heat in the Persian Gulf Command, 1 January 1943–31 July 1944*

[Rates expressed as number per annum per 1,000 mean strength]

Type of trauma	Total cases	Mountain District		Desert District		Gulf District	
		White	Negro	White	Negro	White	Negro
	1 January–31 December 1943						
Mean strength		5,686	280	8,225	1,176	9,343	1,805
Prickly heat	1,353	13.0	0	78.0	3.4	65.4	11.6
Heat exhaustion	1,235	2.6	0	65.0	17.0	61.0	55.0
Heat stroke	38	0	0	.5	0	2.8	4.4
Heat deaths	8	0	0	.24	0	.64	0
	1 January–31 July 1944						
Mean strength		6,684	416	6,879	1,052	10,816	2,325
Prickly heat	277	35.0	0.8	28.0	30.3	3.7	0.7
Heat exhaustion	172	3.4	0	15.0	34.6	9.4	15.6
Heat stroke	4	0	0	.25	3.3	.36	0
Heat deaths	0	0	0	0	0	0	0

Source: Report, Office of the Assistant Chief of Staff for Supply, Headquarters, Persian Gulf Command, to Commanding General, Gulf District, 25 May 1944, subject: Casualties From the Ill-Effects of Heat, appendix No. 9.

reached an incidence rate of 295.81 per 1,000 per annum.⁷ This high rate was largely due to prickly heat and heat exhaustion. The number of heat stroke cases had declined sharply from 115 in 1942 to 38 in 1943, despite a 25-fold increase in command strength. No deaths in Negro troops were attributed to heat trauma. There were eight deaths⁸ in the white group in 1943; none in 1944 (table 15). Prickly heat appeared to be more common in white than in Negro troops. On the other hand, while the heat exhaustion rate was almost equal in 1943, in 1944 it was twice as high in Negro as in white troops. In 1943, the Negro group had twice as many cases of heat stroke as the white group, and in 1944, six times as many. The Negro strength varied between 10 and 20 percent of the command.

Prickly heat was an annoyance rather than a danger, although its effect on morale and efficiency undoubtedly was great. The figures appearing in table 15 underestimate the incidence of this skin condition because many cases did not come to the attention of medical officers. This common skin condition may express itself in a gradient of severity, ranging from mild irritation to an incapacitating dermatitis.

In the summer of 1944, a definite reduction heat trauma took place, despite the fact that the command delivered a record amount of supplies to Russia. This reduction was achieved by instituting proper working hours

⁷ Essential Technical Medical Data, Persian Gulf Service Command, for August 1943, dated 11 Sept. 1943.

⁸ See footnote 6, p. 212.

with a compulsory rest period between 1200 and 1700, during which time vehicles were not allowed to cross the desert except in emergencies; providing comfortably cooled quarters where night crews could sleep in the daytime; installing cooled heat stroke centers at strategically located posts and camp dispensaries; and by training and indoctrinating all personnel in hygienic and preventive measures through bulletins, circulars, and talks.⁹

Application of these measures brought down the peak morbidity rate from 295.81 per 1,000 per annum in July 1943, to 49 per 1,000 per annum in July 1944, and to 41 per 1,000 per annum in August 1945.¹⁰ All these data include cases of prickly heat. Excluding these cases, the rate for July 1944 would be 34 per 1,000 per annum, and for August 1945 it would be only 14 per 1,000 per annum, based on a small strength left behind after the principal mission had been completed.

The failure to stamp out heat injuries even under well-controlled, stable operations is not considered so significant as is the fact that in this hottest place on earth, men could be adapted to perform heavy physical tasks in the sun with no danger to life and with only minor heat illness. Since this command had not been involved in enemy action, there is no way to predict how the troops would have fared under actual battle conditions in hot desert terrain.

China-Burma-India Theater.—The China-Burma-India Theater was organized early in 1942 for supplying the Chinese Army with war materials. Much of the American troop activity was conducted in regions of Burma and India which have a hot-dry climate in the spring, and a typical tropical climate in the summer (map 3). These climatic conditions caused extreme physical discomfort and considerable deterioration of working efficiency,¹¹ especially during the southwest monsoon season.

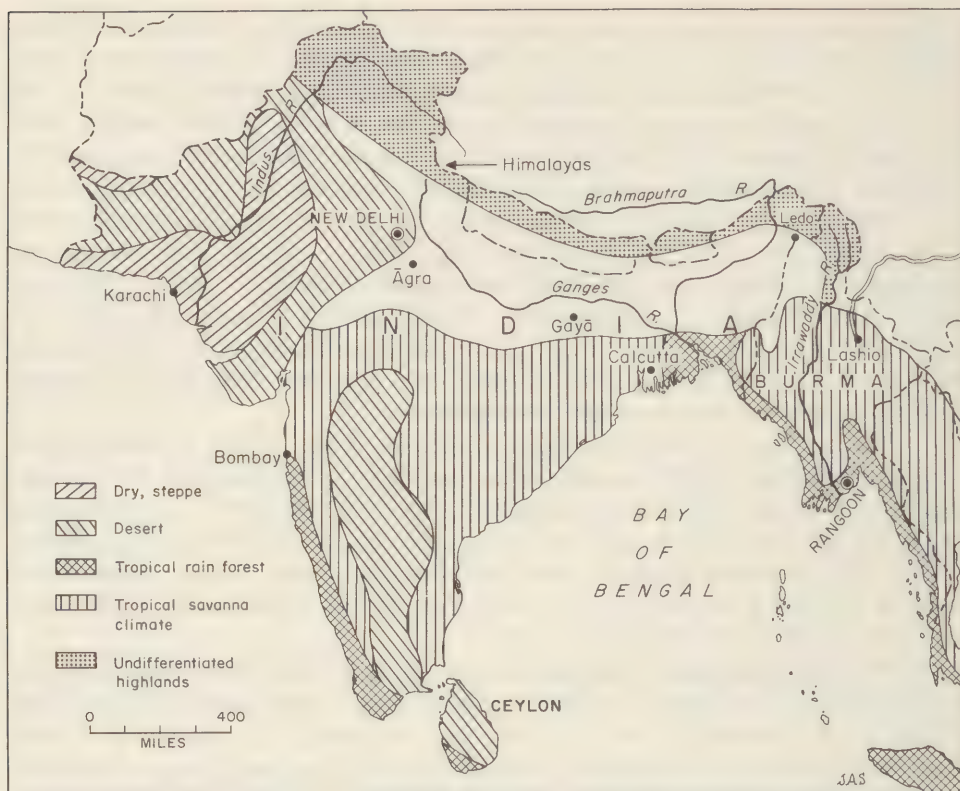
Although heat trauma was a potentially dangerous problem in this theater, rates were high only in the first summer of operations, 1942, and subsided thereafter. Admission rates per 1,000 per annum for heat effects in the entire China-Burma-India Theater in 1942 were 10.97 in May, 70.80 in June, 42.86 in July, and 8.71 in August. The theater strength was then small and the total number of cases was 92, among which two deaths occurred (table 12). Corresponding annual rates for 1943, with a much greater command strength, were 8.91, 6.56, 6.18, and 1.57, and for 1944, 13.31, 13.21, 3.57, and 2.79 (tables 13 and 14).

The increased rates in May and June 1944 were owing to the offensive operations of Brig. Gen. (later Maj. Gen.) Frank D. Merrill's Marauders against the Japanese which culminated in the capture of the Myitkyina airfield. By the time the Marauders reached the area and secured the airfield, they were all but exhausted. During the final stages of the fight

⁹ See footnotes 3, p. 206; and 8, p. 214.

¹⁰ Report, Persian Gulf Service Command, 8 Oct. 1945, subject: Medical History, Persian Gulf Service Command, for the period of 1 January 1945 to 1 October 1945, and inclosure 13 thereto.

¹¹ Van Auken, H. A.: A History of Preventive Medicine in the United States Army Forces of the India-Burma Theater, 1942 to 1945, 8 Dec. 1945, pt. II, pp. 74-75. [Official record.]



MAP 3.—India-Burma area.

for the airstrip, they were so weakened by dysentery, malaria, scrub typhus, malnutrition, and chronic fatigue that some even fell asleep on the firing line. Of approximately 3,000 American troops who originally composed the 5307th Composite Unit (Provisional), only 1,310 reached Myitkyina, and 679 of these were evacuated to rear hospitals.¹² The actual number of cases of heat trauma among these troops is undetermined. Undoubtedly, tropical heat conditions contributed to the seriousness of the several diseases which were encountered. Some of the 950 miscellaneous fevers may have been due to heat trauma. In his account of the expedition, Charlton Ogburn, Jr., refers to the "customary tag reading FUO, meaning Fever of Unknown Origin, though as often as not it might as well have read AOE, or Accumulation of Everything."¹³ This expedition was the only significant battle in this theater in which American troops participated.

By the end of 1944, operations were greatly curtailed as the war moved

¹² U.S. War Department, Military Intelligence Division: Merrill's Marauders (February–May 1944), *American Forces in Action* Series No. 5, 4 June 1945, pp. 113–114.

¹³ Ogburn, Charlton, Jr.: *The Marauders*. New York: Harper & Brothers, 1959, p. 232.

northward. Monthly distribution of heat cases for 1945 is not available, but the total admission rate for that year was only 1.08 per 1,000 average strength, compared with 10.52 for 1942, 2.32 for 1943, and 3.11 for 1944 (table 11).

Preventive measures used for controlling heat diseases in this theater were similar to those instituted in the Persian Gulf Command but were on a smaller scale and were rather late in the war. In areas of excessive heat, barracks frequently were provided with ceiling fans. In hot-dry regions, evaporative coolers (desert water coolers) were used. Mechanical cooling equipment was installed in scrub typhus fever wards of the 20th General Hospital in Ledo, and by the first part of 1945, most of the static hospitals had one ward cooled for alleviating heat discomfort of the very ill patients.

After 1942, acute heat diseases occurred infrequently and then usually in personnel who were doing strenuous work in hot enclosed places. The main diseases causing high noneffective rates were malaria; diarrhea; skin diseases, particularly fungus infections; and the almost universal prickly heat. The surgeon of the American Delhi Military Area Command described the problem of prickly heat in the India-Burma Theater as follows:¹⁴

As trivial a thing as sudamina ("prickly heat"), which is the subject of many a joke, becomes a major problem when it is rampant among troops. Men who are kept awake at night by burning and itching of their skin cannot perform their daily duties with peak efficiency, and when the problem is prolonged into weeks, it has often assumed serious proportions both mental and physical. This consideration is apart from the ever-present danger of secondary infection, a danger that is more real than imaginary as has been found by actual experience. To cite one case; an officer who developed prickly heat eventually found himself with 126 moderate-size furuncles by actual count.

South Pacific areas.—The climate of the south and southwestern Pacific islands ranged from the mild temperate climate of New Zealand to the typical tropical climate of New Georgia, New Hebrides, and Solomon Islands (map 4). New Guinea, New Caledonia, Fiji, and other small islands, had a subtropical climate which was not particularly prejudicial to the health of troops. It should be pointed out that although many of the occupied islands had a tropical climate, they were cooler than the lowlands of Burma and India because of proximity of bases to the sea where cooling breezes afforded some relief.

Complete records are not available for studying heat trauma in the South and Southwest Pacific Areas. Available statistics show that heat trauma in U.S. troops assumed significant proportions only under conditions of combat or during strenuous physical activity. During the height of fighting on Guadalcanal, for example, 141 patients with heat exhaustion were admitted to field hospitals between late November 1942 and mid-February 1943, when the Japanese were finally defeated in this area.

¹⁴ Annual Historical Report, Surgeon, American Delhi Military Area Command, 1945.



MAP 4.—New Guinea and the Solomon Islands.

Compared with admissions for malaria (3,102), dysentery, and other tropical diseases, heat exhaustion ranked tenth and skin diseases eighth as causes for hospitalization. Only two deaths from heat stroke were reported for the entire South Pacific theater between 1 September 1943 and 31 August 1944.¹⁵

In jungle operations by the 41st Infantry Division in Hollandia and Biak Island, heat exhaustion ranked third as a cause of hospital admissions.¹⁶ In the western and southwestern Pacific areas, on the other hand, acute heat illness was infrequent. Only 32 cases of heat exhaustion—18 percent of total admissions—were reported in Army personnel in the western Pacific area, presumably for the whole war period. Of 32 cases, 22 were ascribed to heat and 10 to overexertion.¹⁷ In New Guinea and adjacent islands, only a few cases of heat exhaustion or heat stroke were recorded.

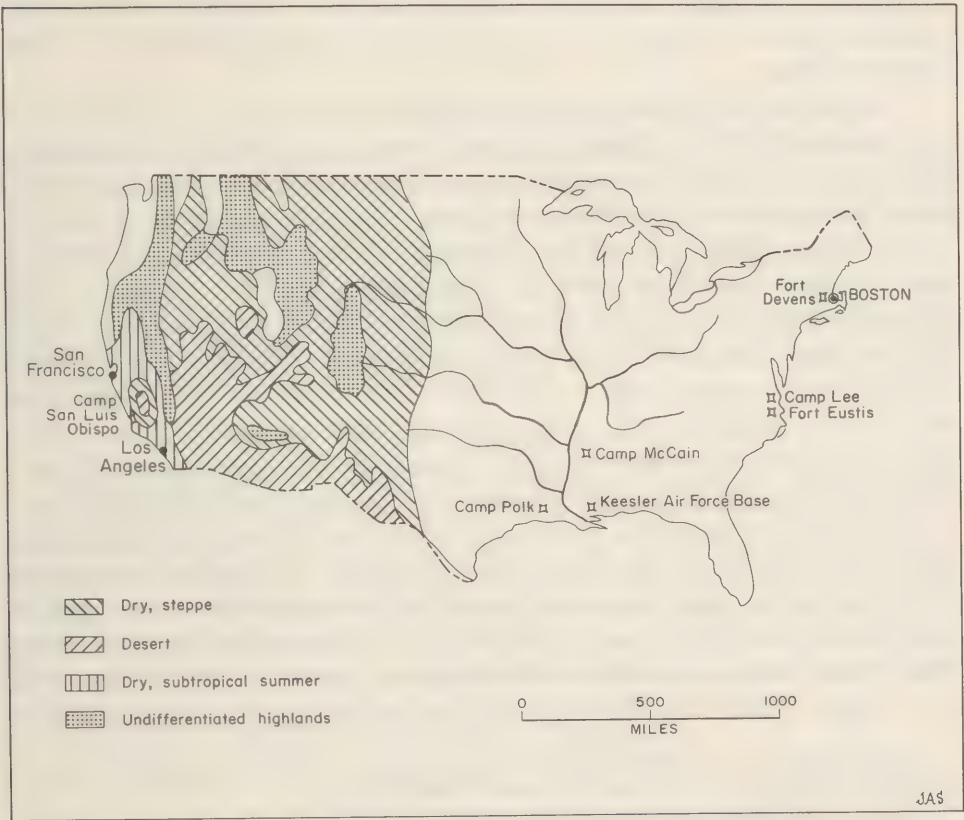
¹⁵ Baker, Benjamin M.: *The History of Internal Medicine in the South Pacific Area*, p. 57. [Official record.]

¹⁶ Report, *Medical History of the 41st Infantry Division*, 1 April 1944 to 30 June 1944, sec. IX, pp. 10-11. [Official record.]

¹⁷ Turner, Glenn O.: *History of Internal Medicine of the Western Pacific Base Command*, 1945. [Official record.]

The most frequent problems reported from the south and southwest islands of the Pacific were malaria, tropical leg ulcers, prickly heat, fungus infections of the feet, reduction in combat efficiency in the absence of any disease, and decreased appetite and body weight after prolonged tropical service. While these conditions are common to tropical areas, they are only indirectly attributable to the effects of heat. By the end of 1944, operations in the South Pacific theaters came to an end as the war moved northward.

Continental United States.—The greatest number of heat casualties in World War II occurred in the United States, where many recruits were in training (map 5). Excluding sunburn and burns, there were 26,936 admissions, with 202 deaths, from heat in the Zone of Interior, compared with 8,462 admissions and 36 deaths in all overseas theaters combined, during the four war years (table 10). Admission rates per 1,000 mean strength per annum for the total war period were: United States, 1.83; overseas, 0.79 (table 11). The rate for the United States was exceeded



MAP 5.—Continental United States.

only in the Middle East and the China-Burma-India theaters. Comparable rates for World War I were 1.61 in the United States, and 0.25 overseas, principally in Europe.

The highest heat morbidity in the United States occurred in the summer of 1943 during the peak of the mobilization period. Annual admission rates per 1,000 strength for the warmest 3 months of 1943 were: June, 7.28; July, 11.15; and August, 8.92, to be compared with 3.58, 3.82, and 2.84, respectively, for the same 3 months of 1944, when preventive measures were in general use. Unfortunately, separate morbidity statistics are not available for the southern and the northern training camps in the continental United States from which to study the distribution of heat disease by region. However, because of the need for adapting troops for combat in hot-humid or hot-dry areas overseas, most of the training was conducted in the southern and southwestern parts of the United States.

The 77th Infantry Division, while training in the desert of southern California, reported a total of 649 heat cases in 1943, up to 3 August. Of these, 183 patients were hospitalized, and the remaining 466 received treatment at battalion and regimental aid stations.¹⁸ Midday summer temperatures ranged between 100° and 120° with relative humidities of from 5 to 15 percent.

Not all units operating in desert areas had such a high heat morbidity. For instance, the 81st Infantry Division, training at Camp San Luis Obispo, Calif., suffered little from heat because the command had instituted a good preventive program immediately after the units arrived in the desert.¹⁹

At Camp McCain in northern Mississippi, the 87th Infantry Division reported 164 admissions for heat exhaustion with three deaths, during July and August 1943. All of the casualties occurred at high environmental temperatures with moderately high humidity and during exercises which required great physical effort. No cases were reported on Sundays when activity and exposure were at a minimum. Heat casualties were brought under control by a change in training hours, strict supervision of training activities by senior commanders, and rigid enforcement of salt discipline.²⁰

At Keesler Field, Miss., on the Gulf of Mexico, where daytime temperatures of 80° to 95° F. (dry-bulb), and 73° to 78° F. (wet-bulb) normally prevail in the summer, there were some 350 heat casualties in the summer of 1942. A total of 99 cases were admitted to the station hospital, among which there was only one death. No hospital admissions were reported on any Sunday during that summer. The trainee strength for that year was

¹⁸ Letter, Surgeon, 77th Infantry Division, to Commanding General, 77th Infantry Division, 3 Aug. 1943, subject: Summary of Medical Experiences and Problems on Desert Maneuvers.

¹⁹ Annual Report, Surgeon, 81st Infantry Division, 1943.

²⁰ Letter, Surgeon, 87th Infantry Division, to The Surgeon General, 2 May 1944, subject: Report of Medical Activities.

21,354.²¹ This camp was among the first to adopt modern preventive measures which went a long way toward reducing heat casualties.²²

At Fort Eustis, Va., from 1 May through 30 September 1943, 265 cases of heat disease were seen at the station hospital: 23 in May, 70 in June, 92 in July, 72 in August, and 7 in September. The mean strength of the command for 1943 was 18,775. Three fatalities occurred in men who had performed strenuous physical exercises in war weather. Maximum daily dry-bulb temperatures seldom approached 95° F., and wet-bulb temperatures seldom rose over 80° F. Preventive measures instituted in the summer of 1943 called for not only a reduction of physical activity when the wet-bulb reading exceeded 75°, but also other secondary control measures.²³

Reports from northern training centers in the United States generally were concerned more with respiratory diseases than with heat effects. However, some camps did report a significant number of heat casualties. For instance, Camp Devens, Mass., reported eight cases of heat trauma among 13,500 men in August 1944.²⁴ With a mean temperature of 74.7°, this was the warmest summer month of the 4 war years at this camp.

PREVENTION OF HEAT INJURY

Epidemiological Approach

Heat injury is caused by the interaction of multiple factors, many of which are not amenable to quantitative evaluation. Although the specific inciting agent is heat, the effects are greatly modified by diverse host and environmental factors, notably physical exercise, which determine fitness for work in the heat and susceptibility to thermal trauma. An epidemiological analysis of causes and total effects in terms of the familiar agent-host-environment triad is the most practical method now available for arriving at a rational preventive program.

Agent Factors

Heat components.—The heat load imposed on a man by a hot outdoor environment depends upon the temperature, humidity, and wind velocity, and upon radiation from the sun, sky, and terrain. At the beginning of World War II, little was known about solar and environmental heat loads or about methods of combining the four physical thermal factors into a single heat index that would indicate the summated environmental heat stress on the human body. Although some laboratory information was

²¹ Adjutant General's Reports, Keesler Field, 1942-43.

²² Wallace, A. W.: Heat Exhaustion. Mil. Surgeon 93: 146-149, August 1943.

²³ (1) Borden, D. L., Waddill, J. F., and Grier, G. S., III: Statistical Study of 265 Cases of Heat Disease. J.A.M.A. 128: 1200-1205, 25 Aug. 1945. (2) Annual Report, Surgeon, Fort Eustis, Va., 1943, pp. 10, 12, and 16.

²⁴ Report, Medical Statistics Branch, Office of The Surgeon General, to Medical Consultants Division, Office of The Surgeon General, subject: Stations Reporting Six or More Injuries Due To Effects of Heat, 1-31 Aug. 1944.

available on tolerance limits for work in the heat, in the absence of solar radiation, field experience, especially in the desert, was virtually lacking.

Upper limits of tolerance for work in the heat.—Hot-chamber studies at the Armored Medical Research Laboratory, Fort Knox, Ky., had placed the tolerable heat limit for sustained marches (3 m.p.h. for 4 hours, with a 9-kg. pack) at 90° F., wet-bulb temperature, with any dry-bulb temperature from 90° to 120°. The marches became progressively more difficult, and heat casualties occurred with increasing frequency at wet-bulb temperatures of 92° to 94°. The subjects of these experiments were healthy, well-acclimatized young soldiers receiving adequate amounts of water and salt.²⁵

Robinson and coworkers reported somewhat similar heat limits for healthy, acclimatized young men walking on a treadmill inside a hot chamber. Radiation had not been considered in these experiments, and the ability of subjects to maintain thermal equilibrium had been taken as a criterion for heat tolerance.²⁶

Persistent reports from theaters had indicated that these laboratory limits were too high, for heat casualties occurred in the field at wet-bulb temperatures much lower than 90° F., especially in the hot-dry regions where wet-bulb temperatures seldom exceeded 78° in the open. Among factors possibly responsible for differences between laboratory and field findings were the state of acclimatization and degree of physical exertion, dehydration and possible salt deficiency, intercurrent infections, and the fact that the laboratory results had taken no account of the added heat stress imposed on personnel in the field by the sun, hot terrain, and hot winds.

The potentially dangerous upper range of climatic conditions for physical work in bright sunshine was found to be associated with wet-bulb temperatures of about 80° F., for seasoned troops, and 75° to 79° F., with dry-bulb temperatures of less than 100° F., for unseasoned troops.²⁷ Schickele arrived at still lower limits from a study of the temperatures and the humidity levels at which 157 healthy soldiers suffered heat death at training centers in the United States during World War II. She found that heat deaths had occurred at wet-bulb temperatures as low as 68° with 110° dry bulb, or at dry bulbs as low as 75° when the air was nearly saturated with moisture (wet bulb near 75°), in soldiers at average activity in the sun for several hours, at various stages of acclimatization ranging from 1 to 12 weeks.²⁸

²⁵ Eichna, L. W., Ashe, W. F., Bean, W. B., and Shelley, W. B.: The Upper Limits of Environmental Heat and Humidity Tolerated by Acclimatized Men Working in Hot Environments. *J. Indust. Hyg. & Toxicol.* 27: 59-84, March 1945.

²⁶ Robinson, S., Turrell, E. S., and Gerking, S. D.: Physiologically Equivalent Conditions of Air Temperature and Humidity. *Am. J. Physiol.* 143: 21-32, January 1945.

²⁷ (1) See footnotes 22 and 23, p. 221. (2) Adolph, E. F.: *Physiological Fitness for the Desert*. Federation Proc. 2: 158-164, September 1943.

²⁸ Schickele, E.: Environment and Fatal Heat Stroke. An Analysis of 157 Cases Occurring in the Army in the U.S. During World War II. *Mil. Surgeon* 100: 235-256, March 1947.

It is difficult to appraise Schickele's findings because no accurate records had been made of the circumstances under which the heat deaths occurred. Nevertheless, it is clear that the critical temperature-humidity limits for men working in the sun are much lower than those found safe in the laboratory where solar radiation is not a factor.

Solar heat load.—Adolph attempted to determine the solar heat burden on men from differences in evaporative sweat loss in the sun and shade. By this method, the load amounted to about 150 calories per hour on clothed men resting or walking in the Colorado Desert of southern California.²⁹ However, this was not the total radiation load, for the shaded men still received reflected and emitted radiation while sitting in the shade. Taking these two components into account, Blum estimated the total solar radiation load at 240 kilocalories per hour on a man of average size, dressed in military clothing, and exposed in a standing position.³⁰

In Adolph's experience, the heat stress in the California desert was about three times greater than in the Florida tropics, owing largely to the higher dry-bulb temperature and higher solar radiation prevailing in the desert. The mean wet-bulb temperature was 10° lower in the desert than in the Tropics.³¹

Composite heat indexes.—Search for ways and means of combining temperature, humidity, air velocity, and radiation into a single heat stress index, had continued during and after the war. Under the auspices of the Office of Scientific Research and Development, Robinson and coworkers developed, in the laboratory, a physiological index of heat stress from observations of heart rates, rectal temperatures, skin temperatures, and rates for sweating.³² Charts were constructed for combining dry- and wet-bulb temperatures producing the same physiological effect at three different rates of work and for two air velocities. Radiation was not taken into account.

Bedford, working under the auspices of the Royal Naval Personnel Research Committee of the Medical Research Council, applied a radiation correction to the standard effective temperature scale by using the temperature shown by a standard 15-cm. black globe thermometer instead of the conventional dry-bulb temperature. It should be pointed out that the globe thermometer integrates the radiation and convection characteristics of an environment into an equivalent dry-bulb temperature which exceeds the shade air temperature by a number of degrees depending on radiation intensity and wind speed. Bedford recommended provisionally that the

²⁹ Adolph, E. F., and associates: *Physiology of Man in the Desert*. New York: Interscience Publishers, Inc., 1947, p. 8.

³⁰ Blum, H. F.: *The Solar Heat Load: Its Relationship to Total Heat Load and Its Relative Importance in the Design of Clothing*. J. Clin. Investigation 24: 712-721, September 1945.

³¹ Adolph, E. F., and associates: *Physiology of Man in the Desert*. New York: Interscience Publishers, Inc., 1947, pp. 317-318.

³² See footnote 26, p. 222.

corrected effective temperature be kept below 80° F., where practicable, and not be allowed to rise above 86° F.³³

The Office of The Quartermaster General, U.S. Army, proposed the "Thermal Acceptance Ratio," estimated by dividing the cooling power of the atmosphere on the nude human body by the metabolic heat production minus the heat loss from the lungs.³⁴ Unfortunately, the death of the major author postponed full development of this concept.

Although several new heat indexes were developed after the war, none of them was entirely satisfactory in predicting human responses to heat. The possibility of developing a good heat index that would apply over a wide range of environmental conditions is still remote.

Host Factors

Activity.—Reports from many military commands in the United States and overseas had stressed the danger of overexertion in the production of heat trauma even in mild weather. As previously noted, most of the heat casualties occurred when troops were either on the offensive or engaged in prolonged strenuous exercises capable of overwhelming the mechanisms of body heat loss.

Restricting physical activity to short periods and to the cooler hours of the morning or evening proved to be the first and foremost measure in controlling heat casualties in the experience of all commands operating in warm areas. Although the working hours were decreased in some instances, the output increased, and the morale improved.

Acclimatization.—While the importance of climate and physical adaptation had long been recognized by physiologists and medical officers, it was not fully appreciated by line officers at the beginning of World War II. Based largely on the work of the Armored Medical Research Laboratory, the experience may be briefly summarized as follows:³⁵

When troops were first exposed to degrees of heat above their accustomed level, they were unable to work strenuously or efficiently for prolonged periods without the threat of heat injury. However, by gradually increasing the amount of work and the length of exposure during the first week or two, compensatory physiological adjustments took place without the development of acute heat symptoms.

In healthy young men under good living conditions, acclimatization began with the first exposure, progressed rapidly, and was fairly well developed by the end of the first week. Full acclimatization took months to develop, but once acquired, it persisted for at least 1 month after return

³³ Bedford, T.: *Environmental Warmth and its Measurement*. Medical Research Council War Memorandum No. 17. London: His Majesty's Stationery Office, 1946, p. 29.

³⁴ Ionides, M., et al.: *Report, Climatic Environmental Protection Section, Office of The Quartermaster General*, 17 Sept. 1945.

³⁵ Bean, W. B., and Eichna, L. W.: *Performance in Relation to Environmental Temperature*. Federation Proc. 2: 144-158, September 1943.

to cooler environments. The acclimatized men sweated more, drank more water, produced a more diluted sweat in the interest of body salt economy, and worked with a lower temperature and pulse rate. They were not immune to heat trauma, but their resistance was greatly increased. Physical work in the heat was essential in the development and maintenance of full acclimatization.

Insufficient acclimatization was held responsible for many heat casualties and deaths in World War II. Most of the heat deaths in the Army occurred in the continental United States during the first few weeks of recruit training in warm weather. According to Schickele's findings,³⁶ about 80 percent of the trainees who suffered heat death came from northern states. Approximately the same geographic distribution held for the incidence of nonfatal heat diseases at Fort Eustis and at Keesler Field.³⁷ Heat deaths in civilian populations showed even more striking effects of geographic origin in the absence of acclimatization. According to statistical data of the Metropolitan Life Insurance Company, a white man living in Wisconsin is 20 times more likely to suffer heat stroke in hot weather than is a white resident of Florida, and about 13 times more likely than one of North Carolina, Alabama, or Mississippi.³⁸

These findings justify sustained efforts to select and acclimatize personnel for service in hot climates. Accordingly, instructions for planning training programs during the acclimatization period were widely disseminated to theaters of operation by the Surgeon General's Office early in the war.³⁹

Race.—In reviewing differences in heat susceptibility between white and Negro troops, Col. Tom F. Whayne, MC, found that in all earlier U.S. wars heat morbidity rates for Negro troops were lower than those for white troops.⁴⁰ However, Negro soldiers seemed susceptible to heat stroke, and once affected by heat, the case fatality rate was higher than that of white troops by as much as 6 to 1. This same ratio seemed to hold for Indian troops in the British Forces, PAIFORCE (Iraq), in 1942 and 1943. Reasons for these apparent racial differences are not clear and require investigation.

Body size.—In World War II, in the Zone of Interior, death due to hyperthermia was three and one-half times more likely among trainees who were 40 pounds overweight than among those who were only 10 pounds overweight.⁴¹ The insulating properties of subcutaneous fat and the low ratio of body surface area to metabolizing mass are believed to make an

³⁶ See footnote 23, p. 222.

³⁷ See footnotes 22 and 23, p. 221.

³⁸ Deaths from Heat and Sunstroke in the United States. Metropolitan Life Insurance Company, Statistical Bulletin 17, July 1936, pp. 1-4.

³⁹ Circular Letter No. 119, Office of The Surgeon General, 3 July 1943.

⁴⁰ Whayne, T. F.: History of Heat Trauma as a War Experience. In *Military Medicine Notes*, Medical Service Company Officer Course 8-0-1(b). Army Medical Service Graduate School, Walter Reed Medical Center, 1951, vol. II, sec. D-5.

⁴¹ See footnote 23, p. 222.

obese person less capable for work in the heat and therefore more susceptible to heat trauma.

Water intake.—The vital need for prompt replacement of water lost by sweating was not generally recognized by line officers in the early part of the war. Commanding officers were then guided by traditional rules of water discipline, as outlined in War Department Basic Field Manual for Desert Operations, FM 31-25, 14 March 1942, which held that in training for desert operations, restricted water consumption would become a habit. The troops were to adapt themselves to live on limited water ration and to develop such self-discipline in the use of water as would assure the maintenance of combat efficiency on the limited water supply available. Rapid drinking of water during the day was to be avoided as nearly all the water consumed was quickly thrown off in excessive perspiration and thus wasted. At the first craving for water, the troops were to moisten their mouths and throats by taking small sips of water from their canteens, thereby lessening their thirst for more water. With the publication of FM 31-25, on 29 October 1955, which superseded the earlier 1942 manual and doctrine on desert operations and water discipline, the serious misconception still held that water should be drunk sparingly by the troops, despite the overwhelming evidence to the contrary acquired during the war.

The concepts that the drinking of water is harmful when a person is warm or perspiring, or that men can be trained to subsist on a low water intake in spite of copious sweating, were completely disproved during the war. It was determined that soldiers marching in the desert or the tropics lost a liter or more of sweat per hour. Rapid water replacement at this high rate produced gastric distress which was avoided by drinking small quantities frequently during work and at mealtimes.

Thirst proved to be an unreliable criterion of rapid tissue dehydration, and thirst quenchers, such as fruit drops, did not allay thirst or reduce the need for water. Continued reduction of body water led to physical deterioration. A water deficit of from 2 to 4 percent of body weight increased the heart rate and body temperature; decreased capacity for physical work; and brought on symptoms of faintness, dyspnea, and restlessness. Dehydration levels of between 5 and 10 percent of body weight rendered any activity impossible, even in well-acclimatized men. No significant saving resulted from depriving men of water, for the deficit had to be made up later whether water was drunk when thirsty or only at mealtimes.⁴² The experience gained was incorporated in Circular Letter No. 119, and was disseminated promptly to all theaters by The Surgeon General.⁴³

Salt intake.—There is no clear evidence that salt deficiency played a major role in the production of heat casualties in World War II, except in isolated cases. As previously stated, heat cramps were rare. In the absence

⁴² See footnotes 29, p. 223; and 35, p. 224.

⁴³ See footnote 39, p. 225.

of information for salt requirements, the need for salt had been over-emphasized by some commands and underestimated by others, especially during the early period of acclimatization when the salt loss was greater than after acclimatization.

Salt requirements of men working in the heat received considerable attention from the beginning of the war, although its role in metabolism, blood circulation, and sweat secretion was never well understood. In the desert, acclimatized troops maintained salt balance with an intake of from 15 to 20 gm. per day, which normally was provided in their regular meals, when the total sweat loss was under 4 liters per day. Unacclimatized troops required from 20 to 30 gm. of salt per day. Supplementary salt intake was best provided by drinking a 0.1-percent salt solution rather than by taking salt tablets. No salt deficiency could be demonstrated under these conditions.⁴⁴

The use of salt tablets produced serious gastric distress and nausea in a significant number of persons, especially when the tablets were taken without water. As a result of adverse experiences, The Surgeon General directed that emphasis be placed on water replacement rather than salt, and that salt in any form should not be taken if water was scarce.⁴⁵ The recommended expedient in such circumstances was to shift the daylight work to the cool night hours in order to conserve body water and reduce salt loss through sweating.

Fatigue of the sweating system.—An important limitation to capacity for work in hot-dry environments was man's ability to maintain a high sweat rate. In moist tropic heat, on the other hand, the limit was set by the atmosphere's capacity to evaporate enough sweat to maintain heat balance. "Fatigue" of the sweating system, as evidenced by a decline of sweating, constituted a potential source of danger on exposure to heat stress involving sweat rates in excess of 4 kg. per square meter per hour.⁴⁶ The amount of decline was greater in humid than in dry heat and was not caused by dehydration, salt deficiency, or lack of acclimatization.

The mechanism of reduced sweating was not ascertained. There was no way to tell whether the derangement was in the sweat glands, in the nervous system, or in the circulation. This should be a fruitful field for physiological investigation.

A new heat syndrome designated as "Hypohidrosis Syndrome," or "Thermogenic Anhidrosis," was reported in desert training areas of the

⁴⁴ Minutes, Conference on Physical Fitness and Adaptation to Climatic Extremes, National Research Council, 11 Dec. 1942.

⁴⁵ War Department Technical Bulletin (TB MED) 175, 10 June 1945.

⁴⁶ Newburgh, L. H. (editor): *Physiology of Heat Regulation and the Science of Clothing*. Philadelphia: W. B. Saunders Co., 1949, pp. 213, 214.

United States,⁴⁷ in the India-Burma Theater,⁴⁸ and in Australia,⁴⁹ after exposure to heat for several months. This syndrome was accompanied or preceded by cessation of sweating, often after a history of excessive sweating. It was not associated with heat exhaustion or heat stroke, although the symptoms were similar to those of heat exhaustion. In the United States, the syndrome was rapidly allayed by removal of the patient from the heat and relief from duty. In the India-Burma Theater, recovery of normal sweat function was much slower, and some of the victims required evacuation to the United States.

Sleep and air conditioning.—It has long been known that a good night's sleep is essential in the prevention of heat trauma and in the maintenance of health and working efficiency in hot climates. In the Persian Gulf District, during the summers of 1942 and 1943, men working on night shifts could not get adequate sleep during the heat of the day, and many heat casualties occurred during this 2-year period. The striking reduction of heat morbidity in the summer of 1944 was ascribed largely to improved living and working conditions. Men were now living in permanent barracks comfortably cooled for sleep and relaxation either by mechanical refrigeration in the southern Gulf District or by evaporative coolers (desert coolers) in arid desert areas.⁵⁰ Evaporative coolers were also used in the India-Burma Theater in the regions subject to periods of extreme dry heat. In areas of humid heat, barracks were frequently equipped with fans.

The ideal air conditions for sleep in hot climates were found to be at a temperature of about 80° F., with a relative humidity of about 45 percent (effective temperature, 75° F.), for heat-acclimatized men sleeping in dry poplin uniforms on beds with mattresses but without blankets.⁵¹ The maximum temperature at which restful sleep could be obtained was 85° F., with 50-percent relative humidity, coinciding with the perspiration threshold.⁵² Men sleeping in compartments cooled to this temperature were able to work efficiently in high heat during the day, whereas all control subjects sleeping in conventionally ventilated quarters suffered prickly heat, and their physical condition gradually deteriorated.

In the Persian Gulf area, too, where prickly heat was a source of discomfort to many men, it was found that persons with extensive involvement could carry on their daily duties by sleeping in cooled wards during the hottest part of the season. In this way, there was sufficient respite to allow them to carry on during the day without being hospitalized.

⁴⁷ Wolkin, J., Goodman, J. I., and Kelley, W. E.: Failure of the Sweat Mechanism in the Desert; Thermogenic Anhidrosis. *J.A.M.A.* 124: 478-482, 19 Feb. 1944.

⁴⁸ Essential Technical Medical Data, U.S. Forces, India-Burma Theater, 10 May 1945. Inclosure 1, subject: Hypohidrosis Syndrome: Report of Cases Seen at the 20th General Hospital, dated 18 Mar. 1945.

⁴⁹ Macpherson, R. K.: Tropical Fatigue. *Univ. Queensland Papers, Dept. Physiol.* 1: 1-162, p. 117, 24 Nov. 1949.

⁵⁰ See footnote 3, p. 206.

⁵¹ Gerking, S. D., and Robinson, S.: Comfort of Men Sleeping in Cool Environments, Interim Report, 70-23 OEM, CMR 351.

⁵² Pace, N., et al.: The Effects of Cool Quarters on Efficiency and Performance of Naval Personnel Working in Hot Spaces. Naval Medical Research Institute, Research Project X-205-1, 22 Nov. 1943.

Nutrition.—Nutrition in the Army is discussed in volume III of the series, *Preventive Medicine in World War II*.⁵³ Summarizing briefly, caloric and water deficiencies sometimes did impair operational fitness and resistance against heat trauma, especially in the early part of the war. In all climates, the relative proportions of protein, carbohydrate, fat, and vitamins consumed in the basic diet were practically constant. Supplementary administration of diverse vitamins, hormones, or drugs had no demonstrable effects on performance in the heat or in the prevention of heat trauma.

Intercurrent and previous illness.—Individual susceptibility to heat trauma was enhanced by intervening infectious diseases, malaria, dysentery, or any febrile condition, including reactions to inoculations; by skin diseases, such as prickly heat or acute sunburn, which interfered with secretion or evaporation of sweat; and by a previous history of heat stroke or vascular disease.

Tropical fatigue and deterioration.—The long-standing and controversial subject of tropical fatigue and deterioration received much study in World War II. Reports from hot theaters overseas had indicated a widespread belief that both physical and mental efficiency of troops coming from temperate regions decreased after serving from 6 months to 2 years in the Tropics, and that the noneffective rate increased in proportion to the length of tropical service, sometimes to the extent of requiring evacuation of personnel.

Joint investigations by allied teams of workers in the southern and western Pacific theaters failed to show any acute deterioration as a result of heat exposure for periods of 1 or 2 years.⁵⁴ Some physical deterioration did occur, as indicated by ill health and by a small but progressive decrease in ability to perform heavy muscular work (Harvard pack test). To a greater extent, however, tropical fatigue seemed to have a psychological rather than a physiological basis in the opinion of most investigators. It was evidenced by widespread discontent, melancholia, and increased incidence of functional disorders. Factors which may predispose psychoneurosis, such as monotony, isolation, improper conditions of service, and domestic troubles, were common among troops serving in tropical or in temperate regions, but the effects of these nonclimatic factors operating on both test and control groups actually were intensified in the tropical groups.

Deterioration occurred less frequently where the nights were cool than where both days and nights were hot. In the China-Burma-India Theater, a definite increase in physical energy and well-being of personnel occurred

⁵³ Youmans, John B.: Nutrition, ch. IV, and Malnutrition and Deficiency Diseases, ch. V. In *Medical Department, United States Army, Preventive Medicine in World War II. Volume III. Personal Health Measures and Immunization*. Washington: U.S. Government Printing Office, 1955.

⁵⁴ (1) Macpherson, R. K.: Tropical Fatigue. *Univ. Queensland Papers, Dept. Physiol.* 1: 1-162, p. 143, 24 Nov. 1949. (2) Minutes, Conference on Working Efficiency and High Temperatures, Committee on Aviation Medicine, National Research Council, 23 Oct. 1945, p. 14.

with the approach of cool weather following the retreating summer monsoons, while in the United States no deterioration was reported in troops undergoing training during the summer season.

In summary, although much has been learned concerning the nature and incidence of tropical deterioration, the question as to how much of the deterioration was due to climatic factors and how much to psychological factors unrelated to climate still remains open for future investigation. Preventive measures recommended by medical officers in the field were: proper selection of personnel for duty in the Tropics, control of work to avoid overfatigue, adequate rest and sleep, good nutrition, moderation in respect to alcohol, routine rotation within the theater or to a temperate climate, and prompt removal from the Tropics when signs of tropical fatigue developed and before evidence of a true tropical syndrome with a breakdown occurred.⁵⁵

Environmental Factors

Clothing.—The physiological preventive medicine aspects governing design of hot-weather military clothing received considerable study during World War II by coordinated effort between the Offices of The Surgeon General and The Quartermaster General and civilian laboratories. The role played by clothing in protecting personnel against excessive heat or cold and against vectors of disease is discussed fully in volume III of the preventive medicine history,⁵⁶ as well as in a book, sponsored by the Division of Medical Sciences, National Research Council, which deals largely with physiological and physical investigations on clothing.⁵⁷

Despite the great advances made in World War II, only limited information was available concerning specialized clothing for the desert or the tropics at the end of the war. The problem was complicated by the need to provide protective clothing against weather, insects, and "the bush," while at the same time allowing for optimum body heat loss. Problems of clothing design in relation to tropical skin diseases also required thorough investigation, for the high incidence of these diseases is an important health hazard of the Tropics.

Housing.—Shelter for protecting troops against heat or cold vectors of disease is fully covered in volume II of the preventive medicine series.⁵⁸

Although little progress was made during the war in the design of military shelters for warm climates, there was no clear evidence that the type of shelter used affected the incidence of heat trauma, except in regions

⁵⁵ Essential Technical Medical Data, U.S. Army Forces in the Middle East, 2 Mar. 1944. Inclosure 2, subject: Mental Fixtures in Tropics, dated 18 Feb. 1944.

⁵⁶ Whayne, Tom F.: Clothing. In Medical Department, United States Army. Preventive Medicine in World War II. Volume III. Personal Health Measures and Immunization. Washington: U.S. Government Printing Office, 1955.

⁵⁷ See footnote 46, p. 227.

⁵⁸ Whayne, Tom F.: Housing. In Medical Department, United States Army. Preventive Medicine in World War II. Volume II. Environmental Hygiene. Washington: U.S. Government Printing Office, 1955.

of extreme heat, as in Iran, or in insect-infested areas of the Tropics, where tight construction of meticulous screening was necessary to control insect-borne diseases. The need for some form of air conditioning has been discussed previously.

Cooled heat stroke rooms.—In the Persian Gulf area and in India, provision of cooled rooms in the hospitals helped greatly in the management of patients with heat stroke as well as of those with seriously debilitating diseases, especially acute febrile diseases such as typhus fever. In this region, the cooled rooms were found ideal for observation and prompt treatment of mild heat cases, some of which were likely to progress to an acute stage. It was reported that before the installation of cooling equipment some of the men who were sent to quarters in a hot barracks or tent with vague complaints developed full-blown symptoms of heat stroke several hours later.⁵⁹

In treating patients with dangerous heat stroke, rapid reduction of body temperature, by the use of ice water and massage over the entire body to prevent shock, was an effective procedure that saved lives when applied promptly. Treatment of most patients with heat exhaustion consisted chiefly of rest in a cool place and judicious oral or intravenous administration of water and salt. Improvement generally was rapid, and in most instances the men returned to duty within 24 hours.

Indoctrination

Inadequate indoctrination of officers and men in the principles of prevention has been held responsible for many of the heat casualties suffered in the early part of the war. For the prevention of heat trauma in the future, the knowledge and experience gained in the past should be incorporated into all training programs of the services, and all military personnel should be indoctrinated and acclimatized at home before going to duty in hot areas overseas.

CONCLUSIONS

Heat injury can be prevented in many instances, or at least controlled within acceptable limits for military situations, by the application of known preventive measures. These measures include selection and gradual adaptation of men for physical work in the heat; provision of appropriate or adequate housing, clothing, diet, water, and salt; control of physical activity, recreation, and alcohol habits; prevention of over-fatigue and infections; and, last but not least, indoctrination of men in how to live and work in hot climates before taking up duty in such areas.

Among other factors affecting heat morbidity were intelligence, morale, discipline, motivation, training, medical care, and the command leadership

⁵⁹ See footnote 3, p. 206.

with which personnel were provided to enable them to counter the heat hazard intelligently.

Prevention of future heat trauma can be greatly facilitated by placing the available knowledge in the hands of all those who should use it and by impressing upon commanding officers their responsibility for enforcing preventive measures. It is essential that the lessons learned in World War II be incorporated into all training programs of the services.

Part II. Cold Injury

William L. Hawley, M.D.

Cold injury affecting large numbers of men is peculiarly a form of wartime trauma. It was one of the most frequent causes of hospital admission in winter fighting during World War II. Occasionally, as in the Aleutians Campaign, casualties caused by cold injury exceeded numerically the wounded in action. Cold injury was almost totally confined to frontline soldiers and, in a cold and wet environment, it increased in proportion to the demands of combat. Unlike minor missile wounds which healed rapidly, cold injury of even moderate degree rendered well-trained and experienced soldiers unfit for further duty for long periods of time, some even permanently. These matters, together with clinical and epidemiological reports and discussions, have been set forth admirably by Whayne and DeBakey in a comprehensive volume in the history of the Medical Department in World War II.⁶⁰

HISTORICAL NOTE

Cold injury has been recorded as a serious problem in winter fighting, even in temperate zones, since the time of Alexander the Great. Its depredations were reported during the American Revolutionary War; its incidence and influencing factors were minutely described by Baron Larrey in the Napoleonic Wars; and it played significant roles in both the Crimean War and the American Civil War.

Appreciation of the military and financial importance of cold injury developed during the first two winters of the First World War. Until this time it had usually been called "frostbite," but the apt term "trenchfoot" was coined by the British when static trench warfare conducive to wet cold feet and sluggish pedal circulation produced 97,414 cases of cold injury during the two winters of 1914 to 1916. Effective means of prevention were developed and enforced, with the result that during the next two winters only 443 cases were reported in the British Expeditionary Forces.

⁶⁰ Medical Department, United States Army. *Cold Injury, Ground Type*. Washington: U.S. Government Printing Office, 1958.

The following major preventive measures were applied:

1. Imposition of command responsibility for enforcement of hygienic measures relating to foot care.
2. Improvement of conditions in the wet trenches; that is, installation of duckboards, and so forth.
3. Provision of adequate supplies of woolen socks and properly fitting loose leather boots.
4. Service of hot foods to men in the trenches.
5. Indoctrination of the individual soldier in practices of personal hygiene to maintain the circulation and warmth of feet.
6. Classification of trenchfoot as a self-inflicted wound.

The American Expeditionary Forces experienced little cold injury in the First World War. Most cases developed during the Meuse-Argonne offensive in October and November 1918 rather than in trench warfare. American commanders from the beginning stressed the British preventive techniques and also prohibited the prolonged wearing of rubber boots. Of 2,061 men admitted to hospital for trenchfoot during the war, 67 cases occurred in the United States and Alaska; most of the remainder occurred in Europe.⁶¹

Between World War I and World War II, the lessons learned in France between 1914 and 1918 were largely forgotten by the American Army. As late as 1941, the Medical Department Soldier's Handbook (TM 8-220) did not mention trenchfoot. The Guide to Therapy for Medical Officers (TM 8-210), issued in March 1942, in discussing foot hygiene, not only did not mention trenchfoot but even stated misguidedly that soldiers' shoes should be snugly laced. The instructions in these manuals were pertinent for a peacetime army wearing tightfitting shoes and clothes which were neatly cut along civilian lines. Although the clothing and its prescribed uses met the demand of peacetime army life in the subtropical and temperate climates of most of the United States, it failed to meet the demands of fighting men in both the arctic and the intense tropical climates of global warfare after 7 December 1941.

THE NATURE OF COLD INJURY

Before describing the Army's experiences with cold injury, it is appropriate to consider in rather general terms the characteristic features of cold injury, its predisposing causes, clinical description, and therapy. For a comprehensive study of the subject, the reader is again referred to the work of Whayne and DeBaakey.⁶²

Included among cold injuries are the frozen fingers of high-altitude fliers, immersion foot of the shipwrecked, and the chilblains, trenchfoot,

⁶¹ The Medical Department of the United States Army in the World War. Washington: Government Printing Office, 1925, vol. XV, pt. 2, *passim*.

⁶² See footnote 60, p. 232.

and frostbite of the foot soldiers. This chapter is chiefly concerned with the last-named types.

Cold injury follows sudden or gradual heat loss from the skin. Rapid freezing of parts, as experienced by high-altitude fliers, quickly produced tissue death, varying in depth according to exposure, with subsequent sloughing and walling off of dead tissue. Injury among fliers was confined almost exclusively to exposed fingers. Wet gangrene of both the superficial skin and the fingertips was associated with injury not involving the nutrient arteries of the finger. Dry gangrene of the finger followed the loss of arterial supply as a result of rapid freezing. Injury from quick freezing is easily comprehensible from everyday experience with thermal burns in the similar chronology of sudden tissue death followed by slow healing from the acute inflammation underlying the tissue.

Our understanding of damage associated with gradual heat loss from a part is less complete, but it is known to be essentially the result of anoxia and of vascular stasis. The lack of familiarity with such trauma in everyday civilian experience, where rudimentary foot hygiene is practiced by even the most ignorant because of associated discomfort, makes the unindoctrinated soldier, officer, or medical officer fail to recognize it. Some early cases seen by medical officers in Italy were misdiagnosed as "sprains." Wet cold, where heat loss from the foot and leg is hastened by heat-conductive properties of wet coverings, first causes a blanching contraction of superficial blood vessels. At skin temperatures of 77° F. to 59° F., cyanosis appears with surface capillary stasis and the beginning of anoxia. Bluish-red discoloration follows as temperature falls from 59° F. to 50° F., associated with alternate constriction and dilation of vessels. Tissue changes appear reversible up to this point in experimental preparations. Tissue anoxia following prolonged lowering of temperature leads to transudation of plasma through injured blood vessel walls, slowing of blood flow, and packing of cells in what may be mechanical occlusion of the vessel. Tissue anoxia is heightened with the progressive loss of blood supply and leads to necrosis of involved tissues, skin, muscle, fat, nerve, and even bone. Other factors obviously affecting the rate of development and intensity of these pathologic changes include all causes which limit circulation to the extremities, such as tight shoes or leggings, physical inactivity of leg muscles, and the general state of nutrition. With rewarming of the part, acute aseptic inflammation is hastened. Blisters are formed from underlying exudate and gangrene of soft tissue. Nerve degeneration, seen in earliest- and latest-stage specimens, included both axis-cylinder and myelin sheath changes. The limited pathologic material available, from amputation in late stages of trenchfoot, and the specimens from acute experimental preparations support these concepts of damage due to cold. The late physiologic effects—sweaty feet, unhealthy skin susceptible to mild trauma—probably represent a combined effect of damaged autonomic nervous innervation and blood vessel damage.

Clinical Description

The symptoms and signs of cold injury, while they have always been of the same general character in all recorded wars, have varied in degree from area to area and from person to person in relation to the severity of weather conditions, the duration of exposure, the extent of tissue damage, the length of time the man has remained in the line after his initial injury, and the kind of treatment he has received between the first point of triage and the first medical installation at which he has received definitive therapy. It has been the universal experience that, if the casualty could not be evacuated by litter or ambulance, the trauma of walking, particularly over rough ground, has increased the severity of symptoms, the extent of tissue damage, and the period of incapacitation.

In general, the symptoms, signs, and clinical progress of cold injury may be summarized as follows:

The initial symptoms variously include numbness, tingling, and a feeling that the feet have become wooden. Walking may be impossible, or the man may complain that he is unable to feel his feet moving when they touch the ground. In other instances, there may be dull or severe drawing pain in the feet and in the back of the legs. There is a universal complaint that the feet are cold. At this time, examination shows the skin to be mottled and of a light bluish-gray color. Edema and blister formation may or may not be present. This is the composite picture in the ischemic stage.

In more severe cases, the next symptom is exquisite pain on touch or on exposure to warmth. The feet are swollen, flushed, dry, hot, tense, and shiny. The edema present is of the pitting variety. Blisters are frequent and intracutaneous ecchymosis may be pronounced. This is the composite picture of the hyperemic stage. Soldiers in World War II often called it the "hot-foot" stage.

As edema subsides, hyperthermia decreases. Blisters break. The surface layers of skin begin to desquamate. The ecchymotic areas turn black and become hard and mummified. The appearance of the lesions suggests dry gangrene. This is the composite picture of the posthyperemic stage (fig. 30).

If ecchymosis has involved the deeper areas of the skin, particularly under heavy callus formation, exfoliation may not be complete for a month or more. The nails are sometimes lost, and entire casts of the toes may be shed. As the mummified layers peel off, the underlying skin appears normal but proves to be extremely delicate. The soldier is unfit for any kind of duty until the plantar surface of the foot and other areas exposed to friction are covered with cornified skin. The universal experience in World War II was that when a soldier had lost the superficial skin on the sole of his foot he was unlikely to return to duty for a considerable period of time, if ever.



FIGURE 30.—Serial changes in trenchfoot. A. Early phase of severe cold injury, with blister formation and beginning gangrenous changes in toes of both feet. Edematous changes have begun to regress, and blister formation on the dorsal aspects of both feet has begun to subside. B. Plantar view of feet on same date as view A. C. Appearance of feet shown in view B, 8 days later. Regressive changes are evident on the dorsal aspects of both feet. Blisters have almost disappeared, and the skin is superficially wrinkled and dry. Mummification has begun in the toes. D. Appearance of feet shown in view C, 9 days later. Note the cracked, scaly appearance of the skin, following disappearance of blisters, and the slowly progressive dry gangrenous changes in the toes on both sides. E. Plantar aspect of feet shown in view D on same date. The changes present in the dorsal view are also evident in this view. Most of the digits on both feet will inevitably be lost by spontaneous separation. (AFIP photographs, B-387-a, b, c, e, f.)

In World War II, the incubation or lag period of cold injury, from the beginning of exposure to the first clinical manifestations of damage, averaged 3 days. It varied, however, from person to person, and was greatly influenced by what had happened during the period of exposure. If the soldier were pinned down in a state of immobility, exposure of even a few hours might give rise to extremely severe injury. If he were fully ambulatory, and especially if he had had opportunities to dry his feet, massage them, and change wet socks for dry, his injury was likely to be mild, or he might escape injury altogether. Surprisingly insignificant factors sometimes weighted the scale in one direction or the other. Experiences are recorded in which the man who left the foxhole daily to secure the rations for his comrades escaped intact, while his companions in the same foxhole all sustained cold injury.

In 633 patients studied from 2 to 13 months after exposure, the degree of tissue damage could not be correlated with duration of exposure. Men who had previously experienced trenchfoot, although more susceptible to subsequent cold injury, were found to be no more likely to develop gangrene than were men who had been exposed only once. Among 619 patients without gangrene, residual manifestations of trenchfoot 4 to 13 months after exposure were chiefly neuritic (hypesthesia, pain, and sweating) and vascular (coldness and absence of arterial pulses) (tables 16 and 17).⁶³

Therapy

Ulcerated gangrenous areas seem to heal excessively slowly in trenchfoot. In uncontrolled observations, lumbar sympathectomy was thought to

TABLE 16.—*Tissue damage in relation to duration of exposure, in 633 patients with trenchfoot, Mayo General Hospital*¹

Lesion	Number of patients	Proportion (percent)	Average period of exposure (days)
No loss of tissue.....	548	86.5	14
Superficial gangrene, slight.....	15	2.4	6
Superficial gangrene, severe.....	33	5.2	9
Partial loss of one or more toes or heel.....	23	3.6	7
Total unilateral loss of one or more toes.....	7	1.1	12
Unilateral loss of toes, partial loss of heel.....	1	.2	4
Total bilateral loss of one or more toes.....	3	.5	6
Bilateral loss of toes, partial loss of foot.....	2	.3	7
Total loss of one or both feet.....	1	.2	12

¹ 10 percent of the patients who lost part of one or more toes or part of the heel, and 7.7 percent of the patients who experienced no loss of tissue had a previous history of frostbite.

Source: Medical Department, United States Army. Cold Injury, Ground Type. Washington: U.S. Government Printing Office, 1958, p. 292.

⁶³ Medical Department, United States Army. Cold Injury, Ground Type. Washington: U.S. Government Printing Office, 1958, pp. 292-293.

TABLE 17.—*Residual manifestations of trenchfoot, 4 to 13 months after exposure, in 619 patients without gangrene, Mayo General Hospital*

[Frequency expressed as percentage of the total group]

Symptoms	Frequency	Signs	Frequency
Hypesthesia	41.5	Cyanosis	59.1
Burning and tingling	21.9	Sweating	50.4
Numbness	16.6	Abnormalities of gait	34.0
Neuritic pains	14.3	Coldness	27.9
Tenderness in sole of foot	14.1	Edema	17.4
Aching	3.8	Muscular atrophy	14.9
		Stiffness of toes	10.2
		Absence of pulsations in large arteries	6.0

Source: Medical Department, United States Army. Cold Injury, Ground Type. Washington: U.S. Government Printing Office, 1958, p. 293.

stimulate the healing process and to render skin grafting more useful. Tube grafts were much more satisfactory than were split-thickness grafts which generally did poorly. Amputations were done as the line of gangrene demarcation became definite and were followed by skin grafting and occasionally lumbar sympathectomy. Direct closure was usually impossible due to infection. Prolonged psychological and physical reconditioning was a necessary part of the medical and surgical therapy.

Epidemiology

Surveys have shown that cold injury is caused by the changing inter-relationships of host, agent, and environmental factors, and by analysis of these varying factors, its epidemiologic behavior may be studied on lines similar to those of communicable diseases. By this means also, preventive and control procedures may be evaluated and applied.

Cold injury is, for the most part, an injury which develops only in troops operating in the wet cold under conditions where the practice of foot hygiene is difficult. Analysis of theater experience has shown that the five major factors in cold injury development are:

1. *The tactical situation.* The committed frontline soldier, immobilized by great personal danger, is the nearly universal victim.
2. *The weather.* Wet, waterlogged terrain, with temperatures between freezing and 50° F., produces the temperature drop in extremities which results in vascular damage and tissue anoxia.
3. *Command responsibility.* The failure to rotate men in and out of the exposed areas with sufficient frequency to allow practice of foot hygiene and the failure to enforce proper hygiene whenever possible increased the incidence of cold injury. The attitude of command was perhaps the profound difference between British and American experience in World War II.

4. *Equipment.* Warm body clothing, water-repellent outer clothing, loose-fitting shoes, extra woolen socks, and sock-rotation schemes are factors in conservation of tissue heat in the feet.

5. *Nutrition.* The lack of hot regular food is conceivably sufficient to affect the general host susceptibility to cold injury.

ACTIONS IN THE ZONE OF INTERIOR

As early as May 1942, Col. (later Brig. Gen.) James S. Simmons, MC, Chief, Preventive Medicine Division, Surgeon General's Office, suggested that the National Research Council initiate studies on health and sanitation in cold environments. The experiences with wet cold in the Aleutians in the spring of 1943 and with high-altitude freeze injury among fliers of the Eighth Air Force operating in England stimulated further study by the Medical Department of the causes of cold injury and the establishment of preventive as well as therapeutic principles in its management. Reviews for The Surgeon General were prepared which covered the clinical aspects, methods of treatment, and military responsibility, as well as available equipment and official training manuals. Recommended changes were accepted by the Surgeon General's Office, and all appropriate agencies were directed to carry out the procedures which had been shown to be effective.

Conferences on Exposure to Cold

Meanwhile, the Division of Medical Sciences of the National Research Council organized in July and in October 1943 two important conferences on exposure to cold. They were attended by representatives of the U.S. Army, the U.S. Navy, the U.S. Public Health Service, the British and Canadian Services, and civilian physicians and surgeons with experience in the management of vascular diseases. The chairman of the conference was Dr. E. M. Landis, Professor of Physiology, Harvard University School of Medicine. At the first meeting, three points were emphasized: (1) Standard clothing and equipment, particularly footgear, had not been efficient in combat under cold conditions; (2) troops had been poorly trained or not trained at all in the personal precautions necessary under Arctic conditions—in fact, both clothing and equipment had been more satisfactory than the manner in which they had been employed; (3) War Department publications, if they mentioned cold injury at all, were universally inadequate and were frequently contradictory. Further training was recommended for military personnel, and articles were to be prepared on immersion foot, frostbite, and trenchfoot. These articles were written, reviewed in detail at the second conference in October, and subsequently

published as official policy on the subjects in the *Bulletin of the United States Army Medical Department*,⁶⁴ and in *Health*.⁶⁵

War Department Publications

As the war progressed and reports from the theaters were received and evaluated in the Surgeon General's Office, memorandums were prepared from time to time by Lt. Col. (later Col.) B. Noland Carter, MC, Chief, Surgery Branch, Surgical Division, and Brig. Gen. Fred W. Rankin, Chief Consultant in Surgery. It became apparent that inadequate instruction, lack of suitable equipment, especially shoes and socks, as well as failure to apply preventive measures with proper authority had been responsible for severe loss of manpower due to cold injury.

Training

Training manuals.—As has been stated previously, trenchfoot was not mentioned in training manuals at the beginning of the war and continued to be virtually ignored in the first wartime revisions. Later, when the importance of cold injury prevention was appreciated, there were still delays in publishing and issuing training material, caused by minor disagreements and printing difficulties. Preparation of educational posters was similarly delayed. Film Bulletin No. 180, an excellent film on trenchfoot, was prepared in the Training Division, Surgeon General's Office, but although it was requested in September 1944 it was not completed and released until March 1945. In summary, adequate training publications did not reach the Mediterranean or European theaters in time to be effective in the control of trenchfoot.

Indoctrination.—In its indoctrination of combat troops, the Training Command made no serious changes until trenchfoot had become a major problem in Italy in the winter of 1943–44. Before that time, it was thought necessary only to train troops in the prevention of cold injury in the Arctic zones. Training became much more vigorous after July 1944. A command letter from Headquarters, Army Ground Forces, to all subordinate commands on 26 August 1944 called attention to the various available publications on the subject and directed that "positive and immediate action" be taken "to insure adequate training, enforce proper hygiene, and fully indoctrinate all individuals." The war was almost ended before satisfactory courses in prevention were being taught in all training areas. By way of

⁶⁴ (1) Immersion Foot. Bull. U.S. Army M. Dept. No. 70, pp. 26–33, November 1943. (2) Frostbite. Bull. U.S. Army M. Dept. No. 71, pp. 24–27, December 1943. (3) Articles on trenchfoot, prepared in the Surgeon General's Office, were also published in the *Bulletin of the United States Army Medical Department* in March, June, and December 1944, and in February, April, May, June, September, and October 1945.

⁶⁵ Monthly Progress Report, Army Service Forces, War Department, 31 Dec. 1943, Section 7: Health. (*Health* was an informative monthly publication prepared in the Surgeon General's Office for Medical Department personnel. Its circulation was limited, and so it was not likely to have been read at lower echelons where control of trenchfoot had to be initiated.)

explanation if not of excuse, it must be realized that priorities had to be selected in a very short time for the many subjects which had to be taught to the enormous number of newly recruited soldiers. Furthermore, even though the Medical Department appreciated the significance of cold injury, it could act only in an advisory capacity since prevention is a command rather than a medical function.

War Department Circular No. 312, section IV, was issued on 22 July 1944, and modified by War Department Circular No. 459 on 4 December. In it, symptoms and preventive procedures were outlined. War Department Technical Bulletin (TB MED) 81 appeared on 4 August 1944, and covered all phases of cold injury, based on experiences in the Italian campaign during the preceding winter. It was unfortunate that these publications were not received at the lowest and most concerned levels in Europe until after the winter weather had set in and cases of trenchfoot had already occurred.

Training for the invasion of Japan.—The impact on the General Staff of the needless loss of fighting manpower in the European theater was profound. As a result, the Pacific theater, when planning the invasion of Japan in the summer of 1945, embarked on an intensive indoctrination and procurement program for the prevention of cold injury. Gen. Douglas MacArthur made commanders clearly responsible if trenchfoot developed among their troops. The practice of good foot hygiene, the importance of proper footgear, and the need for nutritious food in cold weather were all emphasized, and their daily accomplishment was demanded. Specially trained medical teams worked at division level indoctrinating Medical Department personnel; Quartermaster teams demonstrated, at division level, the proper fitting of shoes, shoeboxes, and winter clothing. Quartermaster materials were to be in adequate supply for the winter. These well-coordinated, well-supported preparations were not put to the test, because the occupation of Japan did not occur under combat conditions.

Clothing

The global nature of World War II necessitated reconsideration of Army clothing requirements. To provide suitable clothing, including footgear, gloves, and headgear, for troops in the various combinations of hot, cold, wet, and dry environments, investigations were undertaken by both civilian and Army research groups. Primary responsibility lay with The Quartermaster General, but the Surgeon General's Office, particularly the Preventive Medicine Service, Sanitation Division, played an important advisory role. This subject is fully discussed in volume III of the World War II historical series on preventive medicine.⁶⁶ It is clear that inadequacy of clothing, especially of footgear, was responsible for many casualties

⁶⁶ See footnote 56, p. 230.

during the campaign in the Aleutians, in Italy, and later in the European theater. For example, the war in Europe was almost at an end when the shoe pac had been developed to a satisfactory level both in design and in supply of correct sizes and when men were trained in the correct usage of this and other cold-weather protective clothing.

EXPERIENCE IN OVERSEAS THEATERS⁶⁷

Members of The Surgeon General's staff, and particularly the surgical consultants, were aware of the hazards to the U.S. Army troops from exposure to wet and cold in the various theaters of operation and issued frequent warnings, but for a variety of reasons these were not acted upon in time to prevent great numbers of casualties. The independence of each theater of war, while necessary for military success, seemed to insulate each one from the experience of the others. In succession, each theater was immersed in its own problems of rapidly increasing troop concentrations and of pyramiding staff organizations so that no theater fully comprehended the lessons learned by others in winter fighting until it, too, fought in the wet cold.

General Incidence

In the first significant experience, the Aleutian Campaign in May and June 1943, 1,200 cold injuries occurred in a force of 15,300 and exceeded in number the wounded in action. Five months later, trenchfoot appeared in Italy, and within the five succeeding winter and spring months 5,732 cases were reported, a ratio of trenchfoot to wounded in action of 1 : 5. Having learned much from its first winter's experience, the Mediterranean theater reported 1,572 cases in the winter of 1944-45. In Europe, beginning in October 1944 and continuing through April 1945, 46,107 cases of cold injury were hospitalized, a ratio of trenchfoot to wounded in action of 1 : 4. The total number of cold injury cases compiled from 1942 to 1945 in the European theater was approximately 71,000. These included frostbite, immersion foot, chilblains, and other effects of cold (table 18).

The Aleutian Islands

The occupation of Attu in May and June 1943 required 22 days and a commitment of 15,300 men. A total of 3,829 casualties were sustained. Of these, cold injury accounted for 1,200 by 1 June, exceeding the 1,148 wounded in action, and amounting to 31 percent of casualties from all causes. Following and unopposed landing of American troops, enemy opposition was heavy. The terrain was waterlogged (fig. 31). Evacuation

⁶⁷ Medical Department, United States Army. Cold Injury, Ground Type. Washington: U.S. Government Printing Office, 1958, pp. 83-178 and 491-507.

TABLE 18.—*Incidence¹ of cold injury in the U.S. Army (including the Army Air Forces) by specific diagnosis and theater, 1942-45*

[Preliminary data based on sample tabulations of individual medical records]

Theater or area	Total cold injuries	Trenchfoot	Frostbite	Immersion foot (or hand)	Chilblains	Other effects of cold
All theaters and areas.....	90,535	64,590	19,559	1,451	971	3,964
Continental United States.....	5,203	315	4,342	36	335	175
Total outside continental						
United States..... ²	85,332	64,275	15,217	1,415	636	3,789
Europe.....	71,038	53,911	13,134	506	204	3,283
Mediterranean ³	11,192	9,778	765	322	272	55
Middle East.....	33	22	11			
China-Burma-India.....	35	7	12		15	1
Southwest Pacific.....	578	351	10	214	3	
Central and South Pacific.....	139	26	36	68	1	8
North America ⁴	2,225	145	1,230	295	141	414
Latin America.....	28	25	1	1		1

¹ Consists of both admissions for cold injury and cases in which admission was for other conditions but in which cold injuries appeared as secondary diagnoses. Data on secondary-diagnosis cases are not presently available for 1942 and 1943, and, for these 2 years, only admissions have been included in this table. It should be noted that cold injury admissions in 1942 and 1943 constituted but a small proportion of the World War II admissions for cold injury. For 1942 and 1943, admissions may be considered an approximation of incidence. During 1944-45, in the total Army, the incidence of cold injury exceeded admissions by 11 percent.

² Includes 64 admissions on transports.

³ Includes North Africa.

⁴ Includes Alaska and Iceland.

Source: Medical Department, United States Army. Cold Injury, Ground Type. Washington: U.S. Government Printing Office, 1958, p. 494.

was difficult because of boggy ground, and considerable walking was required of the injured. The fog was dense. Rain fell for 4 days and filled the foxholes with water. Clothing was inadequately waterproofed and windproofed, and for 4 or 5 nights after the initial landing, sleeping bags were not available for riflemen. The leather boot chosen to outfit the invading forces was worn too tightly, was laced to a point below the knee, and could not be waterproofed. Training and preparation for wet cold warfare was insufficient. The task force was made up of an infantry division trained in the Mojave Desert, together with a battalion with 2 years of Alaskan experience. The men trained in the desert did not understand the need for removing boots frequently or for drying socks and inner soles. Many discarded wet socks and wet clothing. Many did not remove their shoes for several days while remaining in wet foxholes. Generally speaking, the incidence of cold injury was proportional to the time in which footgear was not changed and was not related to the ferocity of combat. One scout company, not using the special clothing supplied to it, and without any foot discipline, accumulated 280 cases of cold injury in 5 combat days. Another spearheading battalion with an active foot-care drill, using a "buddy system" for foot massage, experienced only eight casualties from



FIGURE 31.—Tractor and trailer mired down near the beach, Massacre Bay, Attu, 19 May 1943.

cold, although battle casualties among this group were as great as in the other. This initial mass experience of cold injury in combat was sufficient to point out the necessity for proper equipment and clothing, and above all, the major importance of soldier indoctrination regarding foot care and the need for command responsibility in enforcing foot discipline.

Mediterranean (Formerly North African) Theater of Operations

Incidence.—Cold injury was not a problem in the North African operation during the winter of 1942–43. Cases first appeared in the Mediterranean theater in October–November 1943, in fighting in the Apennines. In the ensuing 6 months, 5,700 trenchfoot casualties were reported. Combat casualties in the same period totaled 27,602. The highest cold injury incidence coincided with the greatest incidence of battle casualties. The trenchfoot to battle casualty ratio in December, January, and February 1943–44 was 1 : 4, 1 : 3, and 1 : 5, respectively. In 1944–45, a sharp decline in cold injury paralleled the reduction in combat activity, although the ratio of trenchfoot to battle casualty remained 1 : 4, 1 : 2, and 1 : 6 in December, January, and February 1944–45. By that time, a prevention program was in force.

The Italian Campaign, 1943-44.—In the winter of 1943-44 in Italy, the fighting was heavy. Dry shelter in forward areas was scarce, and hot food could not be provided on the mountainous front for many days at a time. Soldiers lost 10 to 15 pounds in a few weeks when faced constantly with cold rations. On the Anzio beachhead, troops were often confined to waterlogged foxholes.

Cold injury first made its appearance when the temperatures dropped below 50° F., early in November 1943. At the time, rainfall was heavy and southern Italy was a quagmire. Clothing was inadequate for maintaining body warmth. Woolen socks were in short supply. Soldiers who became cold injury casualties were found to have changed socks rarely during the developmental exposure. The provision of dry socks for each soldier with daily rations did not become a theater practice until after April 1944. The regulation army shoe was shown to be too tight even with thin cotton socks, and the pressure on feet grew worse with two layers of thin socks or with heavy woolen socks inside the shoe. The combat boot with its upper cuff, introduced at that time, was found to be no improvement on the blucher last or the regulation army shoe. Galoshes were useful for keeping dry but were too heavy, clumsy, and noisy for men on patrol in the forward areas. They were therefore not used.

The indoctrination of troops coming from the Zone of Interior regarding cold injury prevention was completely inadequate. In a survey of 142 men with cold injury in January and February 1944, none admitted to having been instructed in cold injury prevention. Division replacements who had received no training suffered greater cold casualties than did the older more experienced men. The lesson to Fifth U.S. Army command of its liability in the prevention of cold injury was not evident until February 1944, when a booklet to all command officers in the Mediterranean theater was distributed. It emphasized the principles of hygiene in the maintenance of healthy feet and stressed the function of company officers in prevention. The following winter, individual commanders were required to explain to higher authority any excessive incidence of trenchfoot in their jurisdictions.

The Italian Campaign, 1944-45.—Combat activity during the winter of 1944-45 was less and allowed for more adequate quarters; better rotation of forward area troops; relatively good provision of dry socks and hot food; and enforcement of foot discipline. Supplies of windproof, water-resistant clothing were available, and supplies of socks and shoepacs had improved. Shoepacs became standard footgear in 1944-45, although difficulties in proper sizing resulted in their unpopularity for some time. They proved to be the only really satisfactory footgear for cold weather fighting in the American experience. Only one of every five cold casualties in the winter of 1944-45 was wearing shoepacs. Realizing that the improved cold-weather clothing and other equipment were not being used satisfactorily, the Quartermaster, Fifth U.S. Army, instituted a training course

in the supply and use of winter clothing in November 1944. Courses were conducted for line officers, quartermaster and supply officers, sergeants, and combat troops. Units who did not send representatives were visited later for instructional purposes. The proper use of clothing and footgear was explained; the sizing of shoes, shoepacs, and socks was demonstrated; and instructions were given regarding the drying of wet socks and inner soles inside the sleeping bags or inside the shirt, and on the combinations of socks and soles to be worn within the shoepac. The use of simple devices to insulate feet from direct contact with wet ground in foxholes was shown. Constant stress was given to the removal of shoes and socks even for brief intervals, whether dry socks were available or not.

Comparison with British experience, 1943-45.—The British experience was less severe than the American. The British, fighting in the same area, had trenchfoot to battle casualty ratios for December, January, and February 1943-44, of 1 : 9.5, 1 : 71, and 1 : 27. On the Anzio beachhead, where terrain and weather had no favorites, the British cold injury rate was one-tenth that of the American. Such different experience seemed to stem from command decision to enforce foot discipline, to rotate combat troops in forward areas, and to provide through the quartermaster heavy woolen socks and a loose heavy boot. Soldier motivation for foot discipline was possibly related also to the British classification of cold injury as a "self-inflicted wound." In the winter of 1944-45, the trenchfoot to battle casualty ratio of British and Americans was much closer, 1 : 10 for United States troops, and 1 : 11 for British troops.

European Theater of Operations

Tactical and environmental problems.—The story of trenchfoot in the European theater in 1944-45 started about the time that the pursuit of the German armies across France ended at the Siegfried Line, and combat operations had become more or less static. That was the middle of October 1944. Occasional cases of cold injury had been reported before that time, but they were sporadic, and their possible significance was not generally appreciated. On the Continent, the weather, which had been almost ideal from the beginning of the invasion until the end of September, began to change. It proved to be the wettest, as well as the coldest, winter that Europe had experienced in 30 years. Heavy rains began early in October and continued throughout the month. By November, flood conditions had become general in all Third U.S. Army areas. During that winter, approximately 54,000 men with cold injury received medical treatment in hospitals.

The European theater, like others, was essentially self-contained with respect to command functions. In hopeful anticipation of an early termination of the war by means of a massive cavalry-like chase through France and Germany, precedence was given to the accumulation of fighting equipment instead of protective clothing. Some lack of awareness of the need

for winter clothing suitable for static fighting is comprehensible when it is viewed against the complex background. Organizations were expanding rapidly and commands were multiplying; huge amounts of materiel were being amassed; and complicated training was being accomplished in order to transport the expeditionary force to Normandy in June, and then to break through enemy resistance and race across France. These operations had to be carried out on a rapidly developing thousand-mile front, and by means of an intense struggle to provide equipment and supplies through very inadequate port facilities. This logistical interpretation was the primary factor in the European theater quartermaster's decision to request winter clothing suitable for occupation troops in anticipation of a quick victory rather than cold weather combat clothing. This decision was made contrary to the urging of the Zone of Interior quartermaster and despite available information from the Mediterranean theater. Therefore, when November arrived, only the Seventh U.S. Army and the French First Army, coming up through southern France from the Mediterranean, were properly equipped for winter fighting.

Theater Medical Department activity.—Although the European theater quartermaster general had declined to follow the experience of the Mediterranean theater in providing winter clothing for prevention of cold injury, the Medical Department of the theater was aware of the Italian experience through visits of its medical consultants to Italy. The European surgical consultant advised in April 1944 that rigid discipline must be enforced within combat companies so that socks could be changed daily even though this might mean nothing but wringing them out and putting them on again, adding that U.S. soldiers were invariably fitted with shoes that were too small and the socks furnished to them did not have sufficient wool content for insulation. A command directive regarding care of the feet was prepared by Col. John E. Gordon, MC, Chief, Preventive Medicine Division, Office of the Chief Surgeon, ETOUSA (European Theater of Operations, U.S. Army), in June 1944, in which he emphasized the responsibility of command for the correct fitting of shoes, preferably over heavy woolen socks or over two pairs of light woolen socks; warned against tight lacing of shoes; stressed drying of socks through improvised methods; and urged general care of the feet. This publication was disapproved by the theater adjutant general for general distribution on the grounds that the subject was already covered by existing manuals. Colonel Gordon then informally passed along the information to the surgeons of major commands. In September 1944, Circular Letter No. 108, Headquarters, ETOUSA, dealing with foot care, was prepared by the surgeon for distribution to all commanding officers, including those of smaller units. It was sent to The Adjutant General on 11 October 1944 but did not appear until 24 November, by which time heavy losses from cold injury had already been sustained.

Incidence.—Cold injury appeared early in October 1944. A total of 144 cases were reported the first week, and 320 the next. In the 2-week period ending 17 November, 6,209 cases were reported, a veritable epidemic. These cases developed during the infantry drive toward Metz in the Third U.S. Army area. Rates increased sharply again with the German attack in mid-December in what has come to be known as the Battle of the Bulge. The peak incidence, 3,213 cases, occurred in the week ending 29 December 1944 in forces which were most heavily engaged in this battle. Many of these injuries were frostbite. The cold at that time was intense; the ground was frozen. Incidence again increased in mid-January with the deterioration of already severely cold weather and remained at a level of 3,000 cases per week until 9 February. As the weather began to moderate and as combat activity became lighter, the incidence of cold injury again began to decline. In the week ending 16 February 1945, 1,643 cases were reported, with only 596 the following week. The peak incidence in March was 888 cases for the week ending 9 March. The total number of cases in April was only 230. Almost all the injuries sustained after the middle of February were those of trenchfoot.

Cold injury, although occurring in all field units, concentrated heavily in the riflemen of infantry divisions. Some divisions with well-developed programs of foot discipline had low rates except in difficult tactical situations. Others had poor records in all fighting situations. Losses of 10 and 15 percent or more of strength of single units were not unusual. In the week ending 25 November, for every 100 battle casualties evacuated from the Third U.S. Army, 60 soldiers were evacuated for cold injury. In the Lorraine Campaign in November 1944, the 328th U.S. Infantry Regiment evacuated more than 500 men as casualties from trenchfoot and exposure during the first 4 days of one engagement. This number exceeded the number of battle casualties and made it impossible for the regiment to continue the attack. In all, it lost about 60 percent of its effective strength. During November and December 1944, the total number of cases of cold injury on the western front was more than 23,000. In terms of combat riflemen (4,000 to the division), this loss equaled the fighting strength of five and one-half divisions.

Trenchfoot control teams.—By December 1944, a formal survey of the situation was made by experienced officers. Conferences were held with both medical and line officers, and preventive and control methods as well as indoctrination of troops were outlined and emphasized. Cold injury control teams were set up in January 1945. Each team consisted of a line officer and a Quartermaster Corps officer. By the time these teams became fully operational, however, the weather was improving, enemy resistance was deteriorating, and forces were moving swiftly to victory. Nonetheless, those who watched the program in operation believed that these teams provided an extremely effective means for combating cold injury.

CONCLUSION

The European theater's experience with cold injury resulted in a congressional inquiry initiated by the Mead Committee (Special Committee for the Investigation of the National Defense Program). The report, which was transmitted directly to the Secretary of War, included statements from the Surgeon General's Office. The full lesson had by this time been learned by the War Department: Prevention of cold injury is a triple responsibility shared by command and the Quartermaster and Medical Departments. Plans for the invasion of the Japanese home islands included indoctrination and assured understanding by the leaders in these three areas of the threat posed by fighting in winter weather in flooded rice paddies. Whether these efforts of education and procurement would have held effectively to a minimum the incidence of cold injury among U.S. troops will remain an interesting speculation.

In conclusion, attention is again called to the fact that it is through knowledge of past human experience that future mistakes may be averted. If the experiences of World War I had been remembered, or even if the experiences of World War II itself had been more fully shared, much suffering and heavy military cost might have been prevented.

CHAPTER V

Medical Intelligence

Gaylord W. Anderson, M.D.

INTRODUCTION

Collection of intelligence is as old as war itself. So long as warfare was confined to brute force applied with a certain degree of cunning and surprise, intelligence interest was confined to matters of enemy strength and strategy. In a scientific era, however, technical intelligence is added to the strictly military, for knowledge of the enemy's technical problems and developments is almost as essential as information pertaining to the disposition of his troops. During World War II, medical intelligence was first formally introduced into the U.S. Army and found its place as an essential component of a complete intelligence service.

This was not, however, the first war in which medical problems had played an important and potentially decisive role in determining the course of military operations. For centuries, the gaunt specters of plague and pestilence have set uninvited at the council tables of the generals and, because their warnings went unheeded, have bedeviled and even overthrown the best of military plans. There had never been a war in which disease had failed to cause more deaths than had bullets or shells; in all previous wars, it exacted a heavier toll of life and had been a more important cause of military ineffectiveness. Malaria, typhus, and cholera have decided the course of battle and the destiny of nations, sometimes because man was incapable of combating their ravages; at other times, because he failed to read correctly the pages of history and to make allowances for the inevitable counterattack from these invisible and politically neutral enemies. Nor has disease confined its impartial ravages to the military forces. Too often the civilian population of areas ravaged by war have been a more pitiful victim of disease than were the military forces. Their homes destroyed; their domestic economy thrown off balance; they themselves often forced to the role of refugees, deprived of shelter, food, and medical care—civilian populations have been decimated by disease.

During World War I, American forces had had little need for medical intelligence. American operations were limited to areas with a sanitary culture comparable to that of the United States. Through 2½ years of war in these areas, our allies had gained experience that they might share with us. Sanitary precautions and medical procedures which had become standard Army practices were suitable.

By contrast, World War II was truly global in that it carried American forces to all corners of the earth where they were beset by the greatest diversity of medical problems, many of which were completely strange to them. Diseases were encountered which were known to the majority of U.S. physicians only as interesting textbook curiosities. Troops had to operate under the most diverse climatic conditions—some in the bleak, frigid Arctic; others in barren, arid deserts; and still others in the humid, fever-ridden jungle where disease had for centuries successfully barred the effective entry of civilization. Had we deliberately selected the zones in which disease prevention problems would be the greatest and the most varied, we would have departed but little from the geographic pattern cut out for us by our enemies. Knowledge of hazards that lay ahead of military forces was therefore essential if U.S. troops were to be properly trained and equipped to protect themselves from the hazards of disease, and if suitable disease control measures were to be written into the logistic and operational planning of any campaign.

Mere knowledge of the presence of a disease in a given area was not adequate, however, for the most intelligent use of modern medical and sanitary procedures. Medical science has progressed today to the point where it requires exact and detailed information, not mere generalization, if full use is to be made of scientific advances.

Medical intelligence, as developed in the Preventive Medicine Service of the Surgeon General's Office, therefore, had as its major function the collection of detailed data regarding the health problems and facilities of areas where military forces might be stationed or operating. The basic purpose of this intelligence was to determine the disease hazards to which troops might be exposed so that adequate provisions might be made to combat them. .

Attention to preventable diseases in foreign areas does not constitute, however, a complete program of medical intelligence. Because of the rapid recent progress of medical science and the diverse and new conditions under which these discoveries were being applied, full knowledge of medical and sanitary developments and experiences in other countries and in other armies became important and could not be ignored. To medical intelligence, therefore, fell the task of attempting to keep the Medical Department fully informed regarding medical developments in our own country as well as problems of other countries. All other tasks that were loaded onto it as the war progressed were secondary to this basic mission.

DEVELOPMENT OF MEDICAL INTELLIGENCE

Forerunners of Medical Intelligence

The first forerunner of a comprehensive medical intelligence program in the U.S. Army was initiated in May 1940 by a request to The Surgeon General for information to be incorporated in a War Department basic

field manual on military government, under preparation by the Judge Advocate General's Office.¹ The Surgeon General's Office was requested orally to prepare a few paragraphs on the general functions of a health department and to assist in the draft of a directive, warning the inhabitants to comply with existing health laws.

Although this information was readily furnished by Lt. Col. (later Brig. Gen.) James S. Simmons, MC, then chief of the Preventive Medicine Subdivision, the task called attention to the need for detailed planning for civil public health in such areas and for data regarding local health problems and facilities. Accordingly, two Reserve officers, Lt. Col. (later Col.) Ira V. Hiscock, SnC, professor of public health at the Yale University School of Medicine, and Lt. Col. Albert W. Sweet, SnC, of the New Jersey State Health Department, were called to active duty for periods of 4 weeks and 2 weeks, respectively, to prepare a more detailed plan. The finished report, submitted on 26 June 1940² and entitled "A Plan for the Military Administration of Public Health in Occupied Territory," was general in scope, attempting to delineate principles applicable to all countries. A suggested sanitary code containing detailed regulations was appended.

This plan emphasized the need for specific and detailed information on health and sanitary conditions in individual foreign countries which might be of military importance. Accordingly, the still-meager staff of the Preventive Medicine Subdivision assumed the added task of assembling information of this character.³

France had just fallen, and the Nazi hordes had overrun northwestern Europe and were apparently poised for the ultimate plunge across the Channel toward England. The threat to the United States was obvious to all but the isolationists. Of especial concern were some of the French islands of the West Indies which had remained politically adherent to the Vichy collaborationist regime and, therefore, constituted a serious threat to the Panama Canal and shipping on the entire east coast of the United States. Official and public concern for defense of the Americas was evident.

Surveys of Atlantic and Caribbean Bases, 1939-40

In this situation, the need for immediate collection of detailed information about potential defense bases in the Caribbean was recognized. Accordingly, Lt. Col. (later Col.) William A. Hardenbergh, SnC, and Colonel Sweet were ordered to active duty for 28 days to assemble as much material as could be gathered in this limited time. Attention was focused primarily on the West Indies but secondarily on South and Central America and on

¹ War Department Basic Field Manual FM 27-5, Military Government, 30 July 1940.

² Letter, Lt. Col. Ira V. Hiscock, SnC, and Lt. Col. Albert W. Sweet, SnC, to The Surgeon General, 26 June 1940, subject: Plan for the Administration of Public Health in Occupied Territory.

³ Memorandum, Capt. Tom F. Whayne, MC, for Chief, Preventive Medicine Division, 2 Sept. 1941, subject: General Outline for Activities of Subdivision of Medical Intelligence, Preventive Medicine Division, Including Studies Completed for August 1941.

Canada. With the assistance of the preventive medicine staff, data were assembled from libraries, other governmental agencies, philanthropic foundations, and private industry. This material was incorporated in a series of 52 reports,⁴ a herculean task for so short a time. These reports were inevitably brief and sketchy, and pointed out only the most significant items.

Because of the professional interests and background of the authors, the reports dealt chiefly with water supplies and facilities for waste disposal and only secondarily with medical problems. Viewed in retrospect, it would appear that the chief importance of these reports lay in the fact that their inevitable inadequacies, due to lack of time, emphasized the need for more comprehensive studies of an area before suitable plans could be formulated for dispatch of troops. Further studies on health problems of overseas areas were carried on by Colonel Simmons and his staff of two officers in August 1940 in response to an oral request from the Planning and Training Division of the Surgeon General's Office for information on Greenland, Newfoundland, Labrador, New Brunswick, Nova Scotia, and the French islands of Saint Pierre and Miquelon.

On 20 August 1940, Prime Minister Churchill announced that, in exchange for 50 superannuated destroyers, Great Britain had agreed to lease to the United States certain bases essential for defense of the Western Hemisphere. It was thus apparent that detailed plans must be formulated for the health protection of troops to be sent to construct and man these bases when they were selected. In spite of the "pilot" surveys, the files of the Surgeon General's Office did not contain sufficiently detailed information.

Colonel Hardenbergh was therefore recalled to active duty, and on 2 November 1940, he and Lt. Col. (later Col.) Walter M. Crandall, MC, departed under secret orders to Newfoundland to prepare a sanitary survey.⁵ Simultaneously, an independent survey was being made by Asst. Surg. Gen. Raymond A. Vonderlehr and Passed Asst. Surg. Roger E. Heering of the U.S. Public Health Service. Although these four worked together in the field to avoid duplication of effort, independent reports were submitted on 17 November and on 3 December, respectively. Meanwhile, on 3 November, Lt. Col. (later Brig. Gen.) Leon A. Fox, MC, and Capt. (later Lt. Col.) Harry L. Baker, Jr., SnC, were dispatched to Bermuda to prepare a similar survey; their report was submitted on 13 November 1940.⁶

Both the Newfoundland and the Bermuda reports were comprehensive and detailed. Emphasis was put on factors of environmental sanitation.

⁴ Memorandum, Capt. Tom F. Whayne, MC, for Chief, Preventive Medicine Division, Surgeon General's Office, 30 Sept. 1941, subject: Annual Report of the Subdivision of Medical Intelligence (for the fiscal year ending 31 June 1941).

⁵ Report, Lt. Col. W. A. Hardenbergh, SnC, U.S. Army, subject: Sanitary Survey of Newfoundland, 2-17 Nov. 1940.

⁶ Report, Lt. Col. Leon A. Fox, MC, and Capt. Harry L. Baker, SnC, subject: Sanitary Survey of Bermuda, 3-12 Nov. 1940.

Diseases were treated only briefly for the problems of these areas were those of general sanitation, not the prevention of specific diseases. Not only were the reports of great value in the formulation of plans for the bases later established in these areas, but they also served to show the need for comparable surveys of other areas that might be of military importance.

On 19 November 1940, President Roosevelt announced that bases were to be established at Newfoundland, Bermuda, the Bahamas, Jamaica, Antigua, Saint Lucia, Trinidad, and British Guiana. Hemispheric defense thus became a public reality, and the need for more detailed planning was obvious. The construction of the bases, the first step toward defense, was assigned to the Corps of Engineers. Colonel Fox was assigned in December 1940 as chief health officer of the Caribbean Division (later North Atlantic Division) of the Office of the Chief of Engineers. Immediate responsibility for sanitation of these bases during their period of construction rested with the Corps of Engineers. The Surgeon General's Office remained in an advisory position and was still faced with the need for ultimate planning for the health service and protection of troops to garrison these bases after their construction.

The next 4 months saw three somewhat parallel programs of accumulation of medical data on foreign areas. Between February and June 1941, Colonel Fox, aided by Maj. (later Col.) Huston J. Banton, MC, visited and prepared surveys of all the new bases.⁷ Copies of these reports were dispatched by The Adjutant General to all major headquarters with the direction that certain recommendations contained therein were to be followed.⁸ The reports were thus officially recognized as a basis for administrative procedure. Official recognition of medical intelligence reports was not again achieved until 1944 when they were incorporated into the TB MED (War Department Technical Bulletin) series.

While Colonel Fox and Major Banton were busy with the new defense bases, the Surgeon General's Office was directing its attention to other parts of the Caribbean defense area. Lt. Col. (later Col.) Virgil H. Cornell, MC, was dispatched to Central America where, between 13 February and 20 March 1941, he prepared surveys of Costa Rica, Nicaragua, Honduras, El Salvador, and Guatemala.⁹ In contrast to the Fox-Banton surveys, these remained on an informal basis; aside from copies to the Adjutant General's

⁷ (1) Report, Lt. Col. Leon A. Fox, MC, U.S. Army, subject: Sanitary Survey of Antigua, British West Indies, 17-21 Feb. 1941. (2) Report, Lt. Col. Leon A. Fox, MC, U.S. Army, subject: Sanitary Survey of St. Lucia, British West Indies, 1941. (3) Report, Lt. Col. Leon A. Fox, MC, U.S. Army, subject: Sanitary Survey of Trinidad, British West Indies, 1941. (4) Report, Lt. Col. Leon A. Fox, MC, U.S. Army, subject: Sanitary Survey of British Guiana, 26 Apr.-4 May 1941. (5) Report, Lt. Col. Leon A. Fox, MC, U.S. Army, subject: Sanitary Survey of Newfoundland, 29 Mar.-8 Apr. 1941.

⁸ Letter, The Adjutant General, War Department, to Chief of Engineers, 6 June 1941, subject: Sanitary Surveys of British Guiana and Antigua.

⁹ (1) Report, Lt. Col. V. H. Cornell, MC, U.S. Army, subject: Sanitary Survey of Costa Rica, 13-23 Feb. 1941. (2) Report, Lt. Col. V. H. Cornell, MC, U.S. Army, subject: Sanitary Survey of Nicaragua, 23 Feb.-1 Mar. 1941. (3) Report, Lt. Col. V. H. Cornell, MC, U.S. Army, subject: Sanitary Survey of Honduras, 1-7 Mar. 1941. (4) Report, Lt. Col. V. H. Cornell, MC, U.S. Army, subject: Sanitary Survey of El Salvador, 7-12 Mar. 1941. (5) Report, Lt. Col. V. H. Cornell, MC, U.S. Army, subject: Sanitary Survey of Guatemala, 12-20 Mar. 1941.

Office, to Assistant Chief of Staff, G-4, and to the War Plans Division of the War Department General Staff, distribution was limited to a few parts of the Surgeon General's Office. Meanwhile, Lt. Col. (later Maj. Gen.) George C. Dunham, MC, and Colonel Sweet were sent to Ecuador in March 1941 and later to Brazil and Colombia. Informal reports were prepared by these investigators and became part of the growing file of the Preventive Medicine Subdivision. The surveys of Colonel Dunham were the forerunners of Latin American contacts which later culminated in Colonel Dunham's appointment as director of the Health and Sanitation Division and later, president of the Institute of Inter-American Affairs.

While these several groups of investigators were preparing field surveys, the still-meager staff of preventive medicine was slowly adding information to its files. Such information as could be assembled was gathered from books, medical periodicals, and the files of other agencies. The preventive medicine staff now consisted of only five officers, all of whom had other primary responsibilities. Thus, very little systematic collection or assembly of information was possible, nor was there time to consider areas other than those of most immediate concern in hemispheric defense. Although the country was girding for an overseas war that seemed inevitable, the need of the moment was for defense of the hemisphere. The entire attention of this period was, therefore, focused on the Western Hemisphere and particularly those spots most vital to defense.

Creation of Medical Intelligence Subdivision, 1941

The report of Colonel Hiscock had stressed the need for exact information before planning for civil public health of occupied areas, and the surveys of Colonels Hardenbergh and Fox had shown the value of such detailed information in planning for defense bases.¹⁰ It was recognized, however, that collection of such information required personnel who might devote their entire time to this activity. Accordingly, while additional surveys were being made, plans were being formulated for creation of a special unit in the Surgeon General's Office to undertake this duty. In reply to a request for a statement of actual and anticipated expansion of activities, Colonel Simmons, on 27 December 1940, stated the purposes of the Preventive Medicine Subdivision and presented an outline of activities designed to accomplish them.¹¹ In this memorandum, he proposed a section of medical and health intelligence and research as follows:

Under present conditions, it is important to have information on health conditions and sanitary installations in foreign areas. The purpose of this section is to collect, analyze and summarize current data on disease incidence and health organization and services in areas inside and outside of the United States, and to maintain files of such data for the use of G-2, War Department, and of the Planning and Training Section of

¹⁰ See footnotes 2, p. 253; 5 and 6, p. 254; and 7, p. 255.

¹¹ Memorandum, Lt. Col. James S. Simmons, MC, for the Chief, Professional Service Division, Surgeon General's Office, 27 Dec. 1940, subject: Activities of the Subdivision of Preventive Medicine.

the Surgeon General's Office. The data of this nature already furnished on the Caribbean and Central and South American areas indicate the vital importance of this work:

a. Collection, analyzing, arrangement and filing of medical and health data on foreign countries.

- (1) Disease incidence and mortality data.
- (2) Health Department, organization facilities and efficiency.
- (3) Sanitary facilities, water plants and sewer systems.
- (4) Hospital and laboratory facilities.
- (5) General data—climatic, social, economic, geographic and industrial.

b. Cooperation to these ends with G-2, War Department, the Pan-American Sanitary Bureau, the International Health Division, Rockefeller Foundation, the United States Public Health Service and other agencies.

c. Maintenance of all data on foreign countries in up-to-date status.

d. Development of plans for defense against biologic warfare.

e. Research.

- (1) Collection of information on research in military preventive medicine.
- (2) Maintenance of files on researches in progress.
 - (a) In the Army (liaison with Medical Research Coordinating Board).
 - (b) Elsewhere (liaison with National Research Council and other agencies).
- (3) Investigation of desirable research projects.

This memorandum represents the first formal plan for the systematic collection of medical information as a separate activity. The plan was broad, in that it envisioned also the assembly of information on medical research and the formulation of defense plans against a new type of warfare (biological) that had captivated the imagination of certain persons. The unit as proposed was thus to be a clearinghouse for information, both foreign and domestic, combined with a highly specialized military planning office. One may question whether a unit of such diverse functions could have operated effectively. The test was never made, however, for the plan was subsequently modified.

On 25 February 1941, in a memorandum to The Surgeon General, Colonel Simmons recommended that the staff of the Preventive Medicine Subdivision be expanded by the allotment of additional personnel, and that it be reorganized functionally, preferably as a division, to include several sections, among them one each of medical and health intelligence, tropical medicine, and malaria control.¹² This section was to be divided into three functional units: medical and health intelligence, concerning foreign countries; tropical medicine and sanitation; and malaria control. Authority was requested to procure two additional Medical Corps officers for the section. According to this revised plan, research and biologic warfare were omitted and medical intelligence activities were fused with those of tropical medicine. This plan received official approval on 18 April 1941, by Office Order No. 87, Office of The Surgeon General, when the Preventive Medicine Division was established as an independent division responsible directly to The Surgeon General. The activities of medical intelligence

¹² Memorandum, Lt. Col. J. S. Simmons, MC, for The Surgeon General, 25 Feb. 1941, subject: The Subdivision of Preventive Medicine.

and health, tropical medicine, and malaria control subdivisions were set forth as follows:

Collection and analyses of current data on medical and sanitary facilities, health organizations and disease hazards in foreign countries. Maintenance of files of such data for the use of G-2, War Department, and the Planning and Training Division of the Surgeon General's Office. Collection and coordination of data concerning problems in tropical preventive medicine and sanitation, coordination of the malaria control policy of the Army in the United States and abroad, and the maintenance of files of reports on the incidence and prevention of the diseases indigenous to tropical possessions and bases.

The combination of medical intelligence with tropical medicine and the phrasing of the office order under which the subdivision was authorized are of significance as an expression of the thinking that prevailed at that period. Emphasis was placed on the Tropics and its diseases. Even at this period in 1941, there was appreciation of the important role that tropical diseases were to play in the problem of health protection of the Army, but attention appears to have been focused chiefly, if not solely, on the American jungles, not on the Pacific or Asiatic jungles. The order likewise reflects recognition of the vital importance of exact medical knowledge of such areas, an importance realized in the central planning but unfortunately not always equally appreciated in all theaters of operations.

Although authorized in April 1941, the subdivision did not begin to function as a separate administrative unit until late June 1941 because of lack of suitable personnel.¹³ During the interim, the intelligence activities were held in abeyance, and the tropical disease control work was assumed by the Epidemiology and Industrial Hygiene Subdivision. When finally established, the unit consisted of one officer, Capt. (later Col.) Tom F. Whayne, MC, and a clerk. A second officer was assigned to the subdivision late in July.¹⁴

During the first 6 months of its existence, the new subdivision was engaged primarily in compilation of surveys, revision and extension of the files, preparation of sanitary precautions for task forces, and drafting of maps showing the world distribution of certain communicable diseases. Twenty-three surveys, 10 sets of special sanitary precautions, and two special reports were recorded in the subdivision's reports as having been completed.¹⁵

The new subdivision never assumed responsibility for an active tropical disease control program, possibly because personnel carrying on this work before the reorganization were now assigned to the Epidemiology Subdivision and had continued to carry the load during the interval between

¹³ See footnotes 3, p. 253; and 4, p. 254.

¹⁴ Office Order No. 160, Surgeon General's Office, U.S. Army, 21 June 1941. (2) Office Order No. 205, Surgeon General's Office, U.S. Army, 30 July 1941.

¹⁵ Memorandum, Maj. Tom F. Whayne, MC, for Col. James S. Simmons, Chief, Preventive Medicine Service, Surgeon General's Office, 27 Apr. 1942, subject: Brief Survey of the Activities of the Subdivision of Medical Intelligence for the Year 1941. (See also monthly reports to Chief, Preventive Medicine Service, Surgeon General's Office.)

authorization and actual functioning of medical intelligence. The tropical disease control activities were apparently limited to the preparation of certain health precautions for the Air Corps in which special emphasis was placed on protection against tropical diseases.

First Phase of Expansion, 1941-42

It would be pleasant to be able to record that the outbreak of war in December 1941 found medical intelligence fully informed about the health and sanitary hazards of all areas that were soon to be occupied by U.S. military forces, but such was not the case. Eighteen months before, the Medical Department's files of foreign sanitary intelligence had been literally nonexistent. In the interim, surveys of the defense bases and of many other areas of potential significance to hemispheric defense had been completed. Defense of the Americas had been uppermost in public and official thinking, though many realized that involvement in war would mean overseas operations.

The selection of areas for study by the newly created Medical Intelligence Subdivision had been apparently dictated by considerations of hemispheric defense. Attention had been given to the Caribbean area and to Latin America, following the lead of the Office of the Assistant Chief of Staff, G-2, which was at that time issuing the War Department Strategic Surveys of the Western Hemisphere. The Medical Intelligence Subdivision was, however, directing some attention to the possibility of involvement in the war in Europe and Africa, for a report on Egypt was prepared in July 1941, and reports on Eire (Ireland), Northern Ireland, French West Africa, Iraq, and the Cape Verde Islands, in October. On the other hand, no attention had been devoted to the Pacific area when the strike was made on Pearl Harbor.¹⁶

The Pearl Harbor attack, on 7 December 1941, found medical intelligence in the same state of unpreparedness that then characterized the entire early war effort of the United States. Like industry, and other parts of the War Department, medical intelligence had started to prepare for possible war, but the program was at least 2 years behind the point at which it should have been to be of maximum immediate value. The staff of two officers had collected an amazing amount of information, but two officers in 6 months could not gather the information that should have been assembled over a period of years by a much larger staff of trained observers.

The outbreak of war brought increased demands. Requests for information on various foreign areas increased in number. Closer liaison was established with Military Intelligence Service, G-2, and the duty of preparing the medical section of the War Department Strategic Surveys, which was formerly carried by the nontechnically trained staff of the Office of the Coordinator of Information, later renamed Office of Strategic

¹⁶ See footnote 15, p. 258.

Services, was transferred to medical intelligence.¹⁷ Later, a representative sat with the War Gaming Boards in the final editing of these foreign area surveys.¹⁸ This participation in the preparation of the War Department Strategic Surveys imposed a heavy load of keeping pace with a large staff of investigators attached to the other agencies contributing to these surveys. Yet this participation was of great significance in that it represented the first time in the War Department's history that medicine had been accorded its proper recognition as a discipline to be considered in intelligence planning. Reviewing the medical experiences of subsequent military operations, one might wish that the importance of medical intelligence had been recognized in all theaters as well as in Washington.

With the outbreak of hostilities, a determined effort was made to overcome the handicap due to loss of precious time in gathering adequate medical intelligence while the country was still at peace. By June 1942, the officer allotment had grown from two to only four. A request that it be increased to six pointed out that medical intelligence had the responsibility of furnishing G-2 reports on 60 countries before 1 October 1942, for incorporation in the War Department Strategic Surveys. This request, which was still inadequate for the task ahead, was disapproved by Headquarters, Services of Supply, with the remark that "until such time as Medical officer procurement more nearly meets requirements of troop units, the assigning of additional Medical Officers to overhead activities is not justified." Thus, although the Medical Department appreciated the fact of its prior unpreparedness and was striving by all expedients to compensate for the delay, obstruction to this program was encountered at higher echelon. In spite of the refusal of Headquarters, Services of Supply, to allot additional officers to the pitifully meager staff, some assistance was obtained through use of officers temporarily loaned from the replacement pool at the Army Medical Center, in Washington, D.C. Through this expedient, the total officer staff actually rose to seven.

During 1942, 96 surveys were prepared.¹⁹ Of these, 17 were prepared in the first 3 months.²⁰ Obviously, a staff limited to two officers for half of this 3 months' period and to three for the remainder, and which had only a narrow linguistic capacity, could not prepare adequately detailed reports on 17 countries in 13 weeks. Yet such was the number demanded by the G-2 schedule, adherence to which was essential if the Medical Intelligence Subdivision was to retain the recognition that had been recently gained as the proper agency to write the medical section of the War

¹⁷ Memorandum, Chief, Military Intelligence Branch, G-2, for all Sections, 12 Jan. 1942, subject: Directive on Strategic Surveys.

¹⁸ Memorandum, Chief, Survey Section, Military Intelligence Service, G-2, for all Branch and Section Chiefs, Geographic Branches, 2 July 1942, subject: Medical Paragraph of Strategic Surveys.

¹⁹ Memorandum, Lt. Col. Tom F. Whayne, MC, for Director, Preventive Medicine Division, 20 Feb. 1943, subject: Activities of the Medical Intelligence Branch for the Calendar Year 1942.

²⁰ Memorandum, Chief, Medical Intelligence Subdivision, Surgeon General's Office, for Chief, Preventive Medicine, Surgeon General's Office, 3 Apr. 1942, subject: Report of the Subdivision of Medical Intelligence for the First Quarter (January, February, and March) of 1942.

Department Strategic Surveys.²¹ Accordingly, the reports were prepared and the deadlines met. The inadequacies and inevitable minor errors of the surveys should occasion no surprise. Viewing these months in retrospect, it is remarkable that the data were as complete as they were and the errors so few.

The year 1942 saw, also, much activity with respect to special studies. The North African invasion was in the planning stage. Data were secretly assembled and the information carefully studied by certain medical officers scheduled for this operation.

As the Army Air Forces developed its air routes, information regarding disease hazards to be met was essential to the health protection of personnel assigned to, or traveling over, those routes. Probably no period of the existence of medical intelligence witnessed a heavier demand for special secret reports and studies, and at no time were the files so frequently consulted by others.

In the meantime, several administrative reorganizations had taken place. On 26 March 1942, the Preventive Medicine Division had been elevated to a service status and the Medical Intelligence Subdivision to a division.²² With this reorganization, the tropical disease control functions, which had never been actively developed, were transferred to the Epidemiology Division. The Medical Intelligence Division was informally divided into two subdivisions (Subdivision of Western Hemisphere and Africa, and Subdivision of Asia and Europe).²³ These were further divided into sections and two special sections, one on Abstracts of Current Literature, and one on Maps, were created. When, on 12 August 1942, Preventive Medicine Service reverted to a divisional status under Professional Services and Medical Intelligence Division to a branch status,²⁴ the internal organization was again changed to include four sections: Western Hemisphere and Caribbean Islands; Africa and Pacific Islands; Europe and Asia; and Library Research, Abstracts, and Maps. This division of the branch into sections was more theoretic than real; its rather obvious incongruities were dictated by the need for making the most efficient use of the insufficient personnel.

Second Phase of Expansion, 1943-44

Committee to Study the Medical Department of the Army

On 26 September 1942, the activities of the Medical Intelligence Branch were explained to the Secretary of War's Committee to Study the Medical

²¹ See footnote 17, p. 260.

²² Organization chart, Surgeon General's Office, U.S. Army, 26 Mar. 1942.

²³ Memorandum, Lt. Col. Tom F. Wayne, MC, for Chief, Preventive Medicine Service, Surgeon General's Office, 1 Aug. 1942, subject: Special Annual Report of Activities of the Medical Intelligence Division.

²⁴ (1) Office Order No. 1, Surgeon General's Office, U.S. Army, 12 Aug. 1942. (2) Office Order No. 340, Surgeon General's Office, U.S. Army, 1 Sept. 1942.

Department of the Army.²⁵ The second phase of expansion was initiated by the report of this committee which contained the comment that the branch had "not been developed with full appreciation of [its] * * * importance."²⁶ In keeping with this implied suggestion, the Commanding General, Services of Supply, directed, on 21 December 1942, that the branch be expanded.²⁷ Neither the committee nor the Services of Supply directive specified the scope of activities of the proposed expanded program. After brief study of these recommendations and directives, The Surgeon General, under date of 5 January 1943, made formal request to the Commanding General, Services of Supply, for an additional allotment of 10 officers, three in the grade of major, five captains, and two lieutenants.²⁸ These, added to the five officers then on duty, would have provided the Medical Intelligence Branch with an officer allotment of one lieutenant colonel, three majors, eight captains, and three first lieutenants. At the same time, a request was made for an allotment of seven civilians with ratings between CAF-8 and CAF-13.

This request for additional personnel, although made in reply to the Services of Supply directive and in conformity with the apparent suggestion of the Committee to Study the Medical Department, was completely ignored. Neither in writing nor orally could any reply be obtained from Headquarters, Services of Supply. Finally, on 10 May 1943, after repeated conferences and in response to a new formal request of 7 May,²⁹ approval was received for an increase of military personnel to 15 as originally requested 14 months earlier. The reason for this delay is not apparent.

In the meantime, direction of the branch had been transferred from Colonel Whayne to Maj. (later Lt. Col.) Gaylord W. Anderson, MC, on 27 March 1943. Before his departure to serve as Assistant Military Attaché for Medicine at the American Embassy in London, Colonel Whayne had begun unofficial expansion of the branch pending approval of increased allotment.³⁰ By 10 May, when additional personnel were finally authorized, four additional officers were already on temporary duty, one civilian professional worker was engaged, and a medical editor had been obtained

²⁵ Memorandum, Lt. Col. Tom F. Whayne, MC, for Director, Preventive Medicine Division, Surgeon General's Office, 30 Sept. 1942, subject: Report of the Medical Intelligence Branch, for the Period From 16 September 1942 to 30 September 1942, Inclusive.

²⁶ Report of the Committee to Study the Medical Department of the Army, 1942, Recommendation 61, p. 27.

²⁷ Memorandum, Maj. Gen. William D. Styer, Chief of Staff, for The Surgeon General, 26 Nov. 1942, subject: Report of the Committee to Study the Medical Department of the Army, with 2d indorsement thereto, 21 Dec. 1942.

²⁸ (1) Letter, The Surgeon General, to Commanding General, Services of Supply, 5 Jan. 1943, subject: Medical Intelligence Branch, Preventive Medicine Division, Surgeon General's Office. (2) Memorandum, Maj. Gen. William D. Styer, Chief of Staff, for The Surgeon General, 26 Nov. 1942, subject: Report of the Committee to Study the Medical Department of the Army, with 3d indorsement, The Surgeon General to the Commanding General, Services of Supply, 15 Jan. 1943.

²⁹ Memorandum, The Surgeon General, for Director, Military Personnel Division, Army Service Forces, 7 May 1943, with 1st indorsement thereto, 10 May 1943.

³⁰ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Chief, Preventive Medicine Service, Surgeon General's Office, 29 Jan. 1944, subject: Annual Report of Activities for the Medical Intelligence Branch for 1943.

on loan from the Mayo Clinic. By the end of the year, the staff had been expanded to 11 officers and six civilians of professional rating.³¹

Selection of suitably qualified personnel to meet this expansion presented serious difficulties. The outstanding weaknesses of the Medical Intelligence Branch at the time of the survey by the Committee to Study the Medical Department were its limited linguistic capacity and scanty firsthand acquaintance with foreign areas. During the early period of development when interest was centered on hemispheric defense, this limited capacity had not been a serious handicap, for the available literature was in not more than four languages, and most of it in two. By 1942, however, the war had become truly global, and the interest of medical intelligence had been expanded to embrace countries the medical literature of which was hidden in a babel of foreign tongues. There was an obvious need for an extraordinary breadth of linguistic competence; lacking this, the most valuable storehouses of medical knowledge were locked. By the end of 1943, the linguistic coverage of the staff had expanded from a limited knowledge of French and Spanish to include a fluent knowledge of French, Spanish, German, Italian, Portuguese, Dutch, and Russian, and a satisfactory working knowledge of Danish, Swedish, Norwegian, Polish, Greek, Romanian, Bulgarian, Serbo-Croatian, and Egyptian Arabic.³²

The limited knowledge of Chinese was not serious owing to the paucity of medical literature available only in that language, but the lack of knowledge of Japanese was extremely serious. A staff capable of reading medical Chinese was obtained later. Unfortunately, knowledge of everyday Japanese is far from synonymous with knowledge of medical Japanese; persons with the latter capacity are almost unknown in the United States. Such a person was ultimately located in the person of Dr. Hartwig Kuhlenbeck, Professor of Anatomy at the Woman's Medical College of Pennsylvania in Philadelphia, Pa., who had taught for 3 years in the Imperial Medical School in Tokyo. Although his services were requested on 29 September 1943 and promptly made available by the college, administrative delays prevented his appointment before 5 May 1944.³³ Only part of this delay could be attributed to agencies outside of the Surgeon General's Office. The delay of 8 months in beginning intensive work on an area of such obvious military importance as the Japanese Empire seriously set back the medical intelligence program, a handicap which was never completely overcome.

Although the authorized expansion had specified 15 officers, including one lieutenant colonel and three majors, this goal was never reached.

³¹ To help with the survey load, the service of Dr. C. W. Wells was contributed for 2 months by the International Health Division of the Rockefeller Foundation; Dr. Carl C. Dauer of the District of Columbia Health Department worked for a few weeks on loan from that Department and later on his own free time; and Dr. Orlando Canizares of New York University contributed his services for a few weeks.

³² See footnote 30, p. 262.

³³ (1) Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Chief, Preventive Medicine Service, 1 Apr. 1944, subject: Report of the Medical Intelligence Division for the Period From 16 March to 31 March 1944. (2) War Department Special Orders No. 96, 21 Apr. 1944.

Expansion was stopped at 11 officers,³⁴ and the number of majors never exceeded two. Requests for further officers or grades were denied on the grounds that subsequent ceilings set by directives from ASF (Army Service Forces) (which was the redesignation of the Services of Supply) had countermanded the special allotment authorized on 10 May 1943, and that all personnel were included in a single bulk allotment for installations under control of The Surgeon General. While this was undeniably true, the decision of the executive officer and the Personnel Service to deny further requests for personnel allotment apparently reflected their opinions as to the functions and proper administration of medical intelligence.

The original plan for the medical intelligence program, proposed by Colonel Simmons on 27 December 1940 and later presented before the Committee to Study the Medical Department,³⁵ had embraced a program of broad coverage of medical information. This concept was expressed as follows in the initial letter of 5 January 1943 requesting increased allotment:

* * * The Surgeon General visualizes the expansion of this Branch to include the collection of information and data on an increased number of medical subjects over and above that now collected, i.e. to cover all subjects which might be properly labelled medical intelligence * * *.³⁶

This concept was further elaborated on 15 January, as follows:

This work will be extended to include all medical subjects such as the treatment of the frequent burns sustained in tank warfare, new battlefield surgical procedures as practiced in our own and other armies, etc. Generally the scope will cover not only disease preventive measures, but curative measures as well.³⁷

In keeping with these concepts, the two organization charts of 1942 had both shown a unit for Abstracts of Current Literature.

What informal discussions might have been held with respect to these concepts of medical intelligence can only be surmised. It is obvious, however, that certain persons had envisioned the assignment of officers specially qualified in internal medicine, surgery, neuropsychiatry, and dentistry, and that the function of those officers would be to abstract literature of special interest to the respective divisions.³⁸ Yet, conferences held with those several divisions when expansion was finally authorized revealed that they either felt no need for such an officer or expected that the additional officer would be assigned to their divisions for general work only part of which could be classified under the heading of "intelligence." All agreed that their interests would be adequately served by an arrangement whereby the Medical Intelligence Branch would gather as much medical

³⁴ Finally increased to 12 officers late in 1944 at a period when the additional officer was less critically needed than in 1943.

³⁵ See footnote 25, p. 262.

³⁶ See footnote 28 (1), p. 262.

³⁷ See footnote 28 (2), p. 262.

³⁸ Memorandum, Capt. Harold M. Horack, MC, for Brig. Gen. James S. Simmons, MC, 24 June 1943, subject: Minutes of Meeting for the Discussion of the Collection and Dissemination of Information by the Medical Intelligence Branch.

intelligence material as possible and make the original documents available to all divisions to which they were of potential value. No interest was expressed in the development of a technical abstracting service nor were the abstracts that had been prepared at an earlier date considered of sufficient value to warrant their continuance.

Accordingly, personnel representing special fields of medicine were not obtained, and all attention was given to increasing the collection activities and to providing proper linguistic coverage. This change in program, if it can be interpreted as a change, was apparently looked upon as an acknowledgment of a lack of need for as much personnel as originally requested. Such was not the case. Use of this as a reason for denying the services of a highly qualified medical geographer and for prolonged delay in the appointment of an officer suitably qualified in medical Japanese resulted in a serious crippling of the work that might have been accomplished.

A further factor in the decision to limit the expansion below the point authorized may possibly be found in the relation of medical intelligence to other components of the Surgeon General's Office. The Committee to Study the Medical Department had recommended that medical intelligence be taken out of preventive medicine and placed "in staff relation to The Surgeon General."³⁹ Differences of opinion existed as to this transfer. Colonel Simmons, director of the Preventive Medicine Division, held to the idea that medical intelligence "should not be a separate Division," as the majority of its functions were "matters of military Preventive Medicine, * * * [which should be] correlated with the existing plans and policies of that [Preventive Medicine] Division."⁴⁰

On the other hand, Col. John A. Rogers, MC, executive officer, expressed the belief that the Medical Intelligence Branch should extend its functions to include all matters of medical intelligence, including such things as treatment of burns, new surgical procedures, and other matters of professional interest. The ultimate decision to retain medical intelligence as part of the Preventive Medicine Division⁴¹ was apparently interpreted by many persons as a limitation of its functions to those of preventive medicine. Although in its subsequent collection and dissemination activities a conscious effort was made to serve all other components of the Surgeon General's Office, and although fully half of its activities were more closely related to other parts of the office than to preventive medicine, medical intelligence was to remain a part of the Preventive Medicine Division.

³⁹ Report of the Committee to Study the Medical Department of the Army, 1942, Recommendation 65, p. 28.

⁴⁰ Memorandum, Director, Preventive Medicine Division, Surgeon General's Office, for the Executive Officer, 9 Dec. 1942, subject: Partial List of Recommendations Submitted by the Committee to Study the Medical Department.

⁴¹ Office Order No. 4, Surgeon General's Office, U.S. Army, 1 Jan. 1944.

There can be no doubt that this affiliation was essential to medical intelligence in the early days of its existence. The need for such a program was first recognized by Colonel Simmons early in the development of the preventive medicine program. Without his interest and active support, the program would probably never have been either initiated or developed. After medical intelligence had become of age and the need for its further development had been stressed by the Committee to Study the Medical Department, greater efficiency of operation would probably have been served had it been placed in staff relation to The Surgeon General as suggested by that committee.⁴² Its work became broader than preventive medicine, and its relationship with other components of the Surgeon General's Office was handicapped by a quite general feeling that it was serving the interests of preventive medicine too much and of other divisions too little. While this concept was incorrect, it was to persist throughout the war period and was probably the inevitable result of the unit's position in the administrative chart.

Medical Intelligence Division

Effective with the authorized expansion came a need for a new form of internal organization. Although preliminary plans before the expansion had envisioned a geographic or a professional subdivision of duties,⁴³ study of the operation of the unit led to a decision for a functional arrangement—collection, analysis, and dissemination—the three essential components of any intelligence unit. Such a plan was informally approved in July 1943 and was accorded official recognition on 1 January 1944 when, with re-establishment of the Preventive Medicine Service, medical intelligence regained its divisional status, a status it was to retain throughout the remainder of the war.

The functions of the various branches of the Medical Intelligence Division were established as follows:⁴⁴

Collection Branch. Maintains liaison with Military Intelligence Service for collection of documents of potential interest to the Medical Department, which pass through G-2; maintains similar liaison with Office of Strategic Services, Office of Coordinator of Inter-American Affairs, National Research Council, and other agencies receiving information of medical interest from overseas areas.

Analysis Branch. Prepares studies of medical, health, and sanitary conditions in foreign areas; prepares medical section of War Department Strategic Surveys and of Joint Army Navy Intelligence Studies, including recommendations as to health precautions for forces going abroad; examination of captured materiel and preparation of reports thereon.

⁴² See footnote 39, p. 265.

⁴³ Memorandum, Lt. Col. Tom F. Whayne, MC, Chief, Medical Intelligence Branch, Surgeon General's Office, for Director, Preventive Medicine Division, 17 Mar. 1943, subject: Plan for Expansion of the Medical Intelligence Branch.

⁴⁴ Manual of Organization and Standard Practices, Army Service Forces, Surgeon General's Office, 15 Mar. 1944.

Dissemination Branch. Arranges for dissemination of technical information collected by Medical Intelligence Division, including routing of documents obtained through Military Intelligence Service and other channels; preparation of Medical Intelligence Abstracts.

Collection Branch.—Viewed in retrospect, this functional organization appears to have been the most logical one for the needs of the moment but not necessarily the ideal one. A collection unit was essential to maintain the necessary liaison with G-2, but could never relieve the personnel of the Analysis Branch of the task of assembling their own data for their respective surveys. At best, it could provide smooth and orderly flow of information into medical intelligence, thus simplifying the task of the rest of the staff.

Analysis Branch.—The Analysis Branch should, theoretically, have been organized on a geographic basis. So far as possible this was attempted, but the changing needs for surveys and the shifts of emphasis from one area to another necessitated frequent changes of assignment. Furthermore, linguistic capacities of the staff at times required departure from a strictly geographic pattern of assignment. For example, Portuguese is the official language not only of Portugal but also of Brazil, several sections of Africa, various islands of the Atlantic, a small section hewed out of India, and half of the island of Timor. Few areas of any size can be covered without a broad range of linguistic knowledge. Departure from a geographic pattern of organization was necessary in order to take advantage of such knowledge.

The immediate effect of the expansion of the division was an increase in duties and in the detail with which old duties might be performed. The achievement of adequate linguistic coverage meant that data became available which had previously not been utilized. The new surveys thus became more comprehensive and, by comparison, the old ones became inadequate and in need of revision, especially those of certain areas of greatest military significance. The rapid growth in the amount of information collected required the adoption of new methods of cataloging and filing and the provision of physical facilities for maintaining security for a rapidly growing file of classified documentary material. At the same time, a new plan for dissemination of information had to be evolved if medical intelligence was really to have a broader coverage than merely preventive medicine. Experience had already shown the advantage of overseas collection of data; this phase required further development if full utilization was to be made of the potentially available source material. Finally, the establishment of an ASF Intelligence Division on 30 May 1943, by Army Service Forces Circular No. 36, which attempted to make the intelligence units of the technical services subservient to it, created new and serious problems for medical intelligence and placed upon it a heavy load of miscellaneous responsibilities, many of which hampered its operations, and few of which contributed to the efficiency of its functioning.

By 1 January 1944, when it was reestablished on a divisional basis, Medical Intelligence Division had grown from its original one officer and one clerk to a staff of 11 officers, six civilians of professional rank, and 16 clerks and stenographers. The staff had a remarkably broad linguistic coverage, and a suitably qualified public health engineer, Capt. George O. Pierce, SnC, had been added to the staff to assume responsibility for the collection of information on water supplies and sewage disposal facilities.⁴⁵

Intelligence documents were being collected and added to the file at the rate of almost 1,000 a month, and those of special value to other offices were being distributed on loan in accordance with a planned distribution system.⁴⁶ Surveys of most areas of immediate military significance had been revised or were scheduled for revision, and a formal plan for distribution of surveys was in evolution. Medical Intelligence Division had been recognized by the Joint Chiefs of Staff as the agency to contribute the medical section of the newly created JANIS (Joint Army and Navy Intelligence Studies) which had replaced the War Department Strategic Surveys.⁴⁷ Three medical intelligence officers were on duty overseas, and plans were under development for the assignment of others.

In spite of these evidences of expansion and broadening of functions, it is doubtful whether medical intelligence had achieved all that had been implied in the statement of the Committee to Study the Medical Department that it "had not been developed with full appreciation of [its] * * * importance."⁴⁸ The committee had not been more specific, so that one may merely guess what it had in mind. One may infer, however, that it was attempting to suggest that, if properly developed, the Medical Intelligence Division would serve as a channel for the collection, analysis, and dissemination of information on a wide variety of subjects of vital concern to all components of the Medical Department, that this information would be of value and made available to all medical headquarters and installations, and that it would be utilized in medical planning. In other words, all medical headquarters would be aware of medical intelligence, would appreciate its value, and would feel a lack of information were it not available. Certainly this goal had not been achieved by 1 January 1944, nor was it ever achieved.

Dissemination Branch.—A vast storehouse of medical intelligence had been gathered, and much of the data assembled into formal reports which, if properly used, would have been of inestimable value in medical planning. A broadened distribution of these reports had been achieved, but they were still not available wherever needed nor was their potential usefulness fully realized. Improved channels for dissemination were essential. This was

⁴⁵ Office Order No. 678, Surgeon General's Office, U.S. Army, 7 Sept. 1943, p. 43.

⁴⁶ See footnote 30, p. 262.

⁴⁷ Memorandum, Acting Assistant Chief of Staff, G-2, War Department, Director of Naval Intelligence, and Acting Director, Office of Strategic Services, for all concerned, 1 July 1943, subject: Directive on Joint Army and Navy Intelligence Studies.

⁴⁸ See footnote 26, p. 262.

subsequently achieved through incorporation of reports in the TB MED series and furnished a partial improvement, but at no time was medical intelligence to achieve the role of an essential adviser to overall medical planning. The principal weakness, as of 1 January 1944, was the lack of full utilization of the information assembled by the Medical Intelligence Division.

The year 1944 saw marked improvement in the dissemination function. Surveys were more widely distributed as parts in the TB MED series.⁴⁹ Whereas barely a hundred copies had formerly been sent to a few offices and headquarters, the surveys now became available by the thousands so that they might be distributed to all medical installations. Surveys of all areas of significance to the invasion of northwestern Europe had been made available to the theater.⁵⁰ Full information on Pacific areas on the 1944 invasion schedule was furnished to the theaters well in advance of the start of the campaigns.⁵¹ The failure to use this information or to disseminate it within the theater was a matter beyond the control of the Surgeon General's Office but was a reflection of the lack of appreciation of the potential value of medical intelligence.⁵²

JANIS series.—The development of the JANIS series marked also a forward step in dissemination of medical intelligence. In the War Department Strategic Surveys, the medical section had been but a brief paragraph in a chapter devoted to "The Population and Social Conditions." The original JANIS plan perpetuated this very minor position,⁵³ but, as a result of a series of conferences with the JANIS board, the outline was changed, and the medical section became one of a series of 15 coordinate chapters.⁵⁴

This event, which passed unnoticed except in the divisional semi-monthly report,⁵⁵ merited greater attention than was accorded it, for it marked the first time that the military services had recognized the Medical Department as a major contributor to the intelligence planning of a military operation. It signified acceptance of the fact that full knowledge of medical facilities and hazards is of major concern, parallel in importance with

⁴⁹ Memorandum, Maj. Harold M. Horack, MC, for the Chief, Preventive Medicine Service, Surgeon General's Office, 20 Jan. 1945, subject: Annual Report of the Medical Intelligence Division, Surgeon General's Office, for the Calendar Year 1944.

⁵⁰ These surveys were published as TB MED 38, Medical and Sanitary Data on France, 3 May 1944; TB MED 36 on Belgium, 27 Apr. 1944; TB MED 39 on the Netherlands, 8 May 1944; TB MED 52 on Denmark, 16 June 1944; TB MED 29 on Norway, 4 Apr. 1944; TB MED 27 on Germany, 6 Apr. 1944; and TB MED 59 on Austria, 29 June 1944.

⁵¹ These surveys were TB MED 18, Medical and Sanitary Data on Dutch New Guinea, 10 Mar. 1944; TB MED 20 on Marianna Islands, 15 Mar. 1944; TB MED 57 on Guam, 23 June 1944; TB MED 70 on the Molukken Islands and Islands in the Eastern Part of the Banda Sea, 21 July 1944; and TB MED 68 on the Philippine Islands, 18 July 1944.

⁵² Quarterly Report for History of Medical Department, Surgeon's Office, X Corps, October–December, inclusive, 1944.

⁵³ First appeared as a separate chapter in JANIS 157 on Netherlands and New Guinea, March 1944.

⁵⁴ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Brig. Gen. James S. Simmons, Chief, Preventive Medicine Service, 18 Feb. 1944.

⁵⁵ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for the Chief, Preventive Medicine Service, Surgeon General's Office, 16 May 1944, subject: Report of the Medical Intelligence Division for the Period From 1 May 1944 to 15 May 1944.

knowledge of weather and terrain. Medical intelligence had actually assumed its rightful role in the intelligence field, and the division had become the source to which other parts of the Armed Forces were to turn for their information. This was also reflected in the demands by G-2 and the Joint Chiefs of Staff for special studies—demands which were numerous during the first half of 1944.

In the meantime, other events had broadened the medical intelligence base and increased the load upon the division. A medical intelligence officer had been appointed on the staff of the Chief Surgeon, ETOUSA (European Theater of Operations, U.S. Army),⁵⁶ and another was attached to the JICA (Joint Intelligence Collecting Agency) in the China-Burma-India theater.⁵⁷ A statistical unit for the assembly and orderly tabulation of current and past data on communicable diseases and vital statistics of foreign areas had been created.⁵⁸ Responsibility for handling and processing captured enemy medical equipment had been detailed to medical intelligence⁵⁹ as had also many of the tasks incidental to the exchange of technical information with foreign nationals.⁶⁰ The division had further assumed responsibility for making certain technical intelligence reports available to the National Research Council where they could be brought to the attention of investigators working on problems of vital concern to the Medical Department.⁶¹ Through its liaison with G-2 and the ASF Intelligence Division, many additional minor functions had been loaded onto medical intelligence which had broadened its sphere of interests beyond the scope of preventive medicine.

By the spring of 1944, major interest in surveys was shifting to Japan since the studies essential to the forthcoming European invasion had been completed as had also the studies of the islands that were to be the steppingstones to Japan. The need for a competent Japanese scholar had become increasingly acute, but was not met until May. The loss of time occasioned by the endless delays in his appointment was brought forcibly into focus by demands for medical and health sections for JANIS reports on Japan. These demands, received within 11 days after arrival of a suitable officer on 5 May, called for completion of three reports on 1 August, on 1 September, and on 1 October, respectively. As requests of the Joint Chiefs of Staff had precedence over the surveys of the Medical Department, this meant

⁵⁶ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Director, Preventive Medicine Division, 1 Sept. 1943, subject: Report of the Medical Intelligence Branch for the Period From 16 Aug. 1943 to 31 Aug. 1943, Inclusive.

⁵⁷ Letter, Deputy Surgeon General, to Commanding General, Army Service Forces, 21 July 1943, subject: Medical Officers for J.I.C.A. Groups, with 7th indorsement, Director of Intelligence to the Director, Military Personnel Division, Army Service Forces, 3 Sept. 1943.

⁵⁸ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Director, Preventive Medicine Division, 1 July 1943, subject: Report of the Medical Intelligence Branch for the Period From 16 June 1943 to 30 June 1943, Inclusive.

⁵⁹ (1) Memorandum, The Surgeon General, for Chiefs of Services and Directors of Divisions, 19 Apr. 1943, no subject. (2) The Adjutant General's Office Memorandum No. W570-1-43, 7 Apr. 1943.

⁶⁰ Office Order No. 66, Surgeon General's Office, U.S. Army, 28 Mar. 1944.

⁶¹ Letter, Maj. Gen. Norman T. Kirk, The Surgeon General, to Assistant Chief of Staff, G-2, 3 Nov. 1943, subject: Intelligence Reports Relating to Medical Matters.

that the surveys intended for incorporation in the TB MED series had to be postponed for completion of these JANIS reports. Equally serious, it meant that these reports, which were to become the medical section of highly important documents, had to be completed in a period of time much too limited for the difficulties of the task. Completion of the TB MED surveys was further delayed, late in 1944, by subsequent demands from the JANIS board for reports on other areas under Japanese domination so that the ultimate appearance of TB MED No. 160, Medical and Sanitary Data on Japan, in May 1945, was somewhat late for maximum value.

Enemy equipment collection.—The year 1944 also saw the establishment of an orderly program for the collection of enemy equipment and its return to the Zone of Interior for study purposes,⁶² and the beginning of the program for the collection of information on German scientific progress during the war period. As the ultimate defeat of Germany became a foregone conclusion, War Department attention was focused on the formulation of a program to make certain that the German scientific and technologic advances would be learned and made available to the United States.⁶³ The program was to be a matter of major concern to medical intelligence for the next year, requiring much time and skilled personnel. It again emphasized the fact that an intelligence program, if it is to function properly, must be broader than the confines of preventive medicine or of any other field of medicine.

Aside from these developments, there were few changes in the medical intelligence program during the second half of 1944. Collection activities were being gradually expanded so that more information was being constantly received. Surveys were being printed rapidly in the TB MED series; by the end of the year, 52 had so appeared, and five others were in the hands of the printers.⁶⁴ Chapters for JANIS surveys were being prepared on a monthly schedule, and many special reports had been completed. Dissemination of the surveys had improved but was still far from adequate in the theaters.

The spring of 1945 saw the maximum expansion of medical intelligence. The programs for the collection of enemy equipment and scientific data in Germany were operating at full strength. In all other respects, medical intelligence interest in Washington had shifted from Europe to the Pacific. In Europe, the job was now solely a theater task to be organized on an operational basis; the Medical Intelligence Division had few concerns until the scientific data should be returned. In the Pacific and the Orient, however, the situation was quite the reverse. Military operations were developing on an expanded scale and at an accelerated rate. New and more detailed

⁶² (1) Memorandum, Operations Division, for the Commanding General, Army Service Forces, 27 Jan. 1944, subject: ASF Enemy Equipment Intelligence Service. (2) Memorandum, Commanding General, Army Service Forces, for The Surgeon General, 17 Feb. 1944, subject: Enemy Equipment Intelligence Teams.

⁶³ Memorandum, Deputy Director of Intelligence, Army Service Forces, for Chiefs of Technical Services, 27 Oct. 1944, subject: Intelligence Exploitation of German Surrender, with inclosure of copy of letter to Director of Intelligence, Army Service Forces, from Assistant Chief of Staff, G-2, same subject, 24 Oct. 1944.

⁶⁴ See footnote 49, p. 269.

studies were needed. The demands of the theater and of the JANIS board were heavy but were, in all cases, met. Some rearrangement of staff had been needed to accomplish this, but in no instance was information not available when requested.

Reduction in Program, 1945

It had been expected that the close of the war in Europe would result in an immediate curtailment of the medical intelligence program and, therefore, of staff. The demand of the Pacific theaters and the activity in connection with collection of scientific intelligence in Europe kept the workload undiminished so that the failure of the expected cut in staff was not unwelcome.

The sudden cessation of the war with Japan was, however, the signal for a rapid curtailment in program. Accordingly, a plan for reduction of activities was immediately submitted by which the medical intelligence program would be reduced within 6 months to the previously planned postwar level. This plan called for an orderly termination of each of the programs of activity, completion of all surveys still in progress, and the beginning of a reduced survey schedule based on most obvious postwar needs. Although this program was formally approved by the War Department, it had to be discarded when the Bureau of the Budget ordered further staff reductions.

By 1 October 1945, the staff, which had numbered 12 officers and 21 civilians (five professional and 16 clerical) on 1 April 1945, had been reduced to five officers, one civilian research analyst, and nine clerks; of the officers, one officer, though charged against the division, was to serve as executive officer of the Preventive Medicine Service. The result of the reduction was an immediate discontinuance of certain surveys under preparation. The program for the study of the CIOS (Combined Intelligence Objectives Subcommittee) data had meanwhile been expanded by the dissolution of the Medical Subcommittee, TIIC (Technical Industrial Intelligence Committee), and assignment of its duties to medical intelligence.⁶⁵ Reports on Japanese medical research and technology were beginning to arrive from the Pacific and needed processing and study if they were to be of value to the Medical Department and American science.

The JANIS board had had an extension of life and demanded additional surveys at the rate of six a year, though actually the schedule called for only three before 1 July 1946.⁶⁶ Two of these, however, were the most difficult and most extensive so far demanded. It was thus obvious that personnel had been reduced below the minimum required to meet the division's

⁶⁵ Letter, The Surgeon General, to Executive Secretary, Technical Industrial Intelligence Committee, 27 Sept. 1945, subject: Disestablishment of Medical Subcommittee, TIIC.

⁶⁶ Memorandum, Chairman, Joint Intelligence Committee, for The Surgeon General, 2 Oct. 1945, subject: Participation of The Surgeon General in the JANIS Program and Joint Topographical Subcommittee Activities.

responsibility. To help correct this situation, an additional allotment was obtained whereby an officer released on 30 September could be recalled; the CIOS load was absorbed by temporary duty of an officer charged against the CIOS allotment.⁶⁷ In other words, the situation of 1942 and early 1943 was repeated whereby emergency expedients had to be utilized to offset the lack of authorization for adequate personnel.

The reduction in staff was accompanied by a reorganization of the Preventive Medicine Service, on 18 October 1945 by Office Order No. 291, Office of The Surgeon General, whereby the number of divisions was reduced from 10 to four. The Medical Intelligence Division, which from its earliest days had always been the largest of the divisions, was retained as an entity but had to absorb the Health Education Unit which had formerly been attached directly, but on a nondivisional basis, to the office of the chief of the Preventive Medicine Service. The new division was subdivided into a Medical Intelligence Branch and a Health Education Branch; the three branches of the old Medical Intelligence Division ceased to exist. Close liaison with G-2, through a representative on the reading panel, had to be given up not only by the Medical Department but also by some of the other technical services. All War Department printing was curtailed so that Medical Intelligence Abstracts was discontinued and the Printing Board declined to print certain new surveys in the TB MED series.

Within 3 months, dissemination of new information reverted almost to the level of 1941 and 1942 when it depended largely on personal correspondence and was limited to a few typewritten or Ditto copies. All that remained of the medical intelligence program was completion of a few vital surveys in process of development; preparation of others for the Joint Chiefs of Staff; assembly and release of data on enemy scientific progress; and revamping of the program so that the material so laboriously and hastily gathered under the whiplash of war would not be lost or so scattered that it would not be available for the inevitable demands of the postwar period. The program thus shifted into an attempt to achieve an orderly transition from war to peace in the hope that, when the decision was ultimately made as to the postwar peacetime status of medical intelligence, the lessons learned during the war would not have to be repeated, the labor expended would not have to be respent, and the data assembled would not have to be gathered anew.

COLLECTION OF INTELLIGENCE

The collection of information is the essential first step in the assembly of intelligence, for neither analysis nor dissemination can be made of information not yet assembled. Failure to provide adequate collection results either in collapse of the entire intelligence program or forces the

⁶⁷ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Chief, Preventive Medicine Service, Surgeon General's Office, 2 Nov. 1945, subject: Report of the Medical Intelligence Division for the Period 1 October to 31 October 1945.

analysts to resort to speculation and hypothesis, both dangerous substitutes for fact.

Collection depends on searching out available sources of information and arranging for a regular and orderly flow of data from these sources. To a certain degree, this can be achieved through the establishment of a formal collection unit which maintains liaison with persons and agencies in a position to supply the desired information, but such a program cannot completely replace the need for additional collection of data by the analyst who, from his technical competence, is able to select and draw from the most fruitful sources. In the medical intelligence program, both types of collection were utilized.

Domestic Collection

In the early stages of the program, the analyst was forced to rely solely on his own initiative in tapping suitable sources of information, notably libraries, individuals who had lived in foreign areas, companies with foreign connections, and private agencies with overseas interests. Extensive correspondence was carried on incidental to almost all of the surveys, thus bringing to light bits of information not otherwise available. Countless persons were interviewed; many reviewed surveys before publication or furnished data for subsequent revisions. In some instances, data were obtained on the express condition that the source not be revealed. All of these various sources contributed invaluable information which found its way into the medical intelligence files and, after proper evaluation, appeared in the various surveys. Without such sources, many of the most valuable parts of the surveys would have been lacking. It seems desirable not to attempt to list all sources even for a historical account, lest confidences be violated, or, through omission, a most valuable informant escape due recognition. The files of medical intelligence reveal all but a few of the most confidential.

Some of the more obvious sources can, however, be listed—the libraries, foundations, societies, and other governmental bureaus, as well as the official representatives of Allied Governments. The Library of Congress and the Army Medical Library (now the National Library of Medicine) constituted the most valuable sources for literature research. Stack privileges in both and a study room in the former provided access to important literature without the need of revealing to the library staff the area of immediate interest. This was a valuable arrangement in the maintenance of security. Other libraries of special value included those of the Department of Labor, the Department of Agriculture, the U.S. Public Health Service, the Coast and Geodetic Survey, the Office of Strategic Services, the National Geographic Society, the American Geographical Society, the New York Academy of Medicine, the New York Public Library, and the library of the American Society of Civil Engineers in New York. Among the many gov-

ernment civil agencies should be mentioned the Smithsonian Institution, the Bureau of Entomolgy and Plant Quarantine of the Department of Agriculture, the Coast and Geodetic Survey, the United States Board on Geographic Names, the Department of State, the U.S. Public Health Service, the Office of the Coordinator of Inter-American Affairs (later the Institute of Inter-American Affairs), the Pan American Union and Pan American Sanitary Bureau, and the Bureau of the Census of the Department of Commerce.

Of great value to medical intelligence were the contacts with representatives of certain Allied Governments, especially those in exile. In return, these foreign representatives had access to much technical information of potential value to their respective governments. Relations with the Canadian Government were especially close as the Canadian Army medical liaison officer had office space within the Surgeon General's Office, and representatives of the Medical Intelligence Division of the Royal Canadian Navy made frequent visits and were accorded access to most of the new document acquisitions. In 1943, when the Canadian medical intelligence program was begun, representatives of that office spent 2 weeks in the Surgeon General's medical intelligence office to observe its operation. Highly valuable contacts were also maintained with representatives of Australia, Belgium, China, Great Britain, the Netherlands, and Norway.

Invaluable as were these various direct contacts, most of which resulted in a steady flow of information, there was still a need for a more orderly collection of intelligence to make certain that vital information would not be overlooked and to build an adequate intelligence file for future use. The essential need of medical intelligence was close contact with G-2 and other intelligence agencies in order to obtain access to the wealth of information that flowed into these offices.

Collection through G-2 reading panel

Even before the establishment of medical intelligence, the Surgeon General's Office had some contact with G-2 through its public relations officer who served also in a counterintelligence capacity. To this office, G-2 had sent certain documents selected as of potential interest to the Medical Department. Such an arrangement could not be satisfactory, however, for it depended on the selection of documents by G-2 officers who performed this task as a matter of courtesy and not one of primary interest. Consequently, many valuable items were inevitably overlooked.

The establishment of a separate medical intelligence unit meant that the counterintelligence function was retained by the public relations officer who had no further concern with the collection and internal dissemination of technical information. This was the task of medical intelligence.

The first orderly step toward collection of data from G-2 was taken in October 1942 when, at the request of the Military Intelligence Service,

arrangements were completed whereby a medical intelligence representative was assigned on a part-time basis to the G-2 reading panel where he might scrutinize the documents and arrange for copies of those of medical interest.⁶⁸ Through this arrangement, in which representatives of all other intelligence agencies in Washington shared, the liaison officer spent half of each day in the Medical Intelligence Branch, and half in G-2 where, besides serving on the reading panel, he maintained close contact not only with G-2 but also with all other participating intelligence agencies. Most classified intelligence documents of real value to the technical services found their way to the reading panel. The officer assigned to this task became in reality a liaison officer between the Surgeon General's Office and G-2, except for matters pertaining to counterintelligence, and, at the same time, a technical adviser to G-2 on items of medical significance. The relationship so established was apparently equally profitable to both offices.

This liaison with G-2 continued throughout the war despite several threats to its efficient operation. The first of these came in the summer of 1943 coincidental with establishment of the ASF Intelligence Division by Army Service Forces Circular No. 36. Immediately after establishment, this new organization sent an informal directive to each of the technical services requesting that the officer on the reading panel be turned over to the ASF Intelligence Division and that the technical service accept a corresponding reduction in officer allotment in favor of an increase in allotment to ASF Intelligence Division. This first move in a never-ending, but always unsuccessful, attempt to gain control of the technical service intelligence units was met with a unanimous and emphatic refusal from the technical services.⁶⁹ As the request, though coming from a higher echelon, was presented merely as signed carbon copies of an informal memorandum, the technical services were in a position to refuse. Failing to achieve formal control, ASF intelligence resorted to continual but unsuccessful attempts at informal direction. If control of the liaison officers had passed either formally or informally to ASF intelligence, their usefulness to their respective services would have been at an end, as their effectiveness depended on their role as G-2 representatives of the technical services.

A second serious threat to the effectiveness of the G-2 liaison came in the reorganization of the reading panel in 1944, coincidental with the revamping of G-2. Part of the reorganization was a proposal that the liaison officers from the technical services spend their entire time at the reading panel. This proposal was protested by the technical services on

⁶⁸ (1) See footnote 19, p. 260. (2) Officers serving in this capacity with grades while on such service were Capt. William A. Howard, MC; Lt. David M. Greely, MC; Capt. Carlo Henze, MC; Capt. Stewart C. Thomson, MC; and Capt. John H. Garwacki, MC.

⁶⁹ Memorandum, Col. J. M. Roamer, MC, Director of Intelligence, Army Service Forces, for Chiefs of all Technical Services, Army Service Forces, 19 June 1943, with 1st indorsement, The Surgeon General to Director of Intelligence, 7 July 1943. A similar reply was made by the other technical services.

the basis that full time on the panel was unnecessary and would destroy the liaison relationship in that it would preclude contact with the office of the technical service that each officer represented. After a few days, the plan was abandoned.

This part-time arrangement continued until after V-J Day and reductions in force were effected as part of demobilization. By this date, the number of documents obtained through the reading panel had so declined that medical intelligence could hardly afford to assign one of its five remaining officers to this task.⁷⁰ Accordingly, arrangements were made whereby the ASF Intelligence Division representative on the panel would select documents of interest to the Medical Department. While this examination provided some document scrutiny and selection, it had the serious disadvantage of severing the close liaison with G-2. The loss was fully realized, yet there was no alternative in view of the load still to be carried by medical intelligence with a sharply reduced staff.

Tabulation of disease statistics

The expansion of medical intelligence in 1943 made possible the realization of a recognized need for orderly and regular collection of statistics on past and current prevalence of communicable diseases in foreign areas. Search for data incidental to the surveys had shown that, although many Washington bureaus had certain types of morbidity or mortality data, no agency was attempting a reasonably complete international compilation. Many of the data normally available in times of peace were now lacking because of breakdown in reporting systems and international exchange of epidemiologic intelligence. Yet, brief items as to disease occurrence were available from widely scattered sources, items which, if properly assembled, would reveal the current prevalence and trend of diseases in foreign areas. So long as normal reporting channels were destroyed, these miscellaneous items often constituted the chief source of information. It was, therefore, highly important that some plan be evolved which would provide for orderly tabulation of whatever information was available.

To this end, a statistical unit of two clerks was established within the Collection Section of the Medical Intelligence Branch in June 1943.⁷¹ All documents containing statistics of disease occurrence in foreign areas were routed through this unit where the data were tabulated on cards. The difficulties of such a task were great because of the multiplicity of sources of variable reliability, the varied manner in which the data were presented, and the lack of continuity of reports from many sources.

⁷⁰ (1) Memorandum, Col. Robert J. Carpenter, MC, Executive Officer, Surgeon General's Office, for Director of Intelligence, Army Service Forces, 27 Sept. 1945, subject: G-2 Reading Panel. (2) Memorandum, Director, Medical Intelligence Division, Surgeon General's Office, for Chief, Preventive Medicine Service, Surgeon General's Office, 14 Aug. 1945, subject: Reduction of Medical Intelligence Activities After V-J Day.

⁷¹ See footnote 58, p. 270.

Frequently, a given source would yield a single item of information missing from other sources dealing with the same area. Parallel sources might reveal inexplicable discrepancies which posed the problem of determining relative reliability. In spite of these difficulties, the unit assembled a priceless collection of morbidity and mortality statistics more complete than that of any other Washington agency. While an enlarged organization would doubtless have provided better coverage through a more careful scrutiny of foreign periodicals and papers, it is doubtful if the added details would have made any significant difference in the interpretation. Most of the current data were mere approximations at best, but were adequate to reveal the trends. This was all that was required.

Interviews with returned military personnel

As the war progressed, the number of persons who could furnish firsthand information on foreign areas was swelled by military personnel returning from overseas. These persons often had knowledge of theater conditions, medical problems in combat zones, and problems incidental to field use of medical equipment.

If medical intelligence had been in a staff position where it obviously served all parts of the Surgeon General's Office, collection of information from such interviews of Medical Department personnel might have come within its province. As information so obtained was of chief benefit to the Operations Service, the latter created a special unit, the Inspection Branch, for this function.⁷² Duplication of effort was avoided by an informal agreement whereby the Medical Intelligence Division confined itself to collection of data regarding foreign countries and their military forces, whereas the Inspection Branch inquired into problems and experiences of American forces in foreign areas. This division of duties produced some duplication of interviews which might have been avoided had the functions been fused under one office. The division meant that medical intelligence could never occupy the position of a comprehensive informational unit.

Of far less value were interviews of other types of returning personnel at ports of debarkation and in general hospitals. As the need for counter-intelligence declined, officers released by G-2 were absorbed under ASF Intelligence Division aegis and assigned to "positive intelligence" work which consisted of interviews of returnees.⁷³ As the interviewing officers lacked technical training, they were unable to elicit worthwhile technical information even though an attempt had been made to brief them and they had been furnished lists of topics in which the technical services were interested. The interviews too often yielded vague generalizations or infor-

⁷² (1) Memorandum, The Surgeon General, for All Visiting Officers, 17 Sept. 1943, subject: Interviewing Visiting Officers. (2) Office Order No. 141, Surgeon General's Office, U.S. Army, 15 June 1945.

⁷³ Memorandum, Col. J. M. Roamer, MC, Director of Intelligence, Army Service Forces, for The Surgeon General, 29 July 1944, subject: Collection of Technical Information From Returned Army Personnel.

mation about events that had happened as long as 2 years earlier. Furthermore, no attempt was made to estimate the competence of the individual interviewed or to limit the questioning to subjects about which the returnee might be presumed to have valuable information.

These many defects would have been a matter of little consequence had not ASF intelligence thrust the interviews upon medical intelligence with a demand for reports on action taken by The Surgeon General to correct the situations recorded. Reports on suggestions that a colorless Atabrine (quinacrine hydrochloride) be used, that Atabrine be incorporated in the rations to avoid failure to take the Atabrine (Army rations can be unappetizing enough without being dyed yellow), and that Atabrine be replaced by the "vastly superior" mepacrine hydrochloride (which the interviewer failed to recognize as the British pharmacopoeial term for Atabrine) are time consuming without accomplishing more than annoyance. Although the reports contained occasional items of value to the training and morale programs, the yield from the Medical Department's point of view did not warrant the labor entailed. As sources of technical overseas intelligence, they were of little value.

Theater reports

By way of contrast, the monthly reports from the chief surgeon of each theater did contain much valuable information. These reports, established in July 1943⁷⁴ and known as Essential Technical Medical Data, were processed in the Inspection Branch of the Operations Service. In general, they were the most fertile source of information about U.S. experience in the theaters. Also contained in these reports was a vast amount of information about local medical and sanitary conditions which was of prime interest to medical intelligence and often served as a check on the accuracy and adequacy of the surveys. In some instances, special appendixes to these reports furnished the most valuable source of information about certain areas. The monthly sanitary reports submitted from all field units, on the other hand, were usually devoid of information of medical intelligence value. The monthly sanitary reports were used less and less until the point was reached where they were all but ignored in the medical intelligence program.

Many other highly valuable reports came in from overseas units. Prominent among these were the reports of the 18th and 19th General Laboratories, the Naval Medical Research Unit No. 2 in the Pacific,⁷⁵ malaria control units, special surveys of water supplies and of rodent control practices, and the countless historical reports of overseas units.

⁷⁴ Letter, The Adjutant General, 14 July 1943, subject: Essential Technical Medical Data From Overseas Forces.

⁷⁵ (1) Headquarters, 18th Medical General Laboratory, 23 Jan. 1946, subject: Annual Report, Medical Department Activities, 1945. (2) Semimonthly Report, 19th Medical Service Detachment (General Laboratory), 1-15 Mar. 1945. (3) Monthly Reports, U.S. Naval Medical Research Unit No. 2, 1 Oct.-1 Nov. 1945 and 1 Nov.-1 Dec. 1945, subject: Report for Island Command War Diary.

These accounts were scanned by medical intelligence and frequently yielded highly valuable data. Full utilization was not made of these sources, however, as the staff was under such pressure for studies of new areas that it could not devote enough time to the important, but somewhat less urgent, task of keeping the old surveys up to date by insertion of data gleaned from reports of this character.

Prisoner-of-war interrogation

Interrogation of prisoners of war has always been a standard intelligence procedure, the value of which is so obvious and well proved that it needs no justification. Under the circumstances, it would have been logical to assume that this technique would have played a prominent role in the collection of medical intelligence. Yet, extremely little use was made of this technique either in the Zone of Interior or in the theaters.

During the early phases of the war, German and Japanese prisoners were too few in number to justify an attempt at interrogation. By the fall of 1943, however, German prisoners began to be shipped to the United States and, by the middle of 1944, medical officers were available for questioning. The attitude of the Japanese toward capture, especially in the early stages of the war, resulted in a small number of prisoners for interrogation, but ultimately a few were brought to the United States. It was logical, therefore, that attempts should be made to have an officer of the Medical Intelligence Division participate in their interrogation, inasmuch as the staff included officers with a perfect knowledge of German and a high degree of fluency in Italian and Japanese. Yet, in spite of repeated requests for permission to interview these prisoners, no satisfactory arrangements were ever achieved.

Requests for permission to interview German medical officers were denied by G-2 on the ground that "unqualified" interrogators might "spoil" the prisoners for further questioning.⁷⁶ G-2 proposed that (1) medical intelligence assign one of its officers to G-2 on a full-time basis for this work but still be charged against the medical intelligence allotment or that (2) medical intelligence submit a set of questions to be put to the prisoners by the "qualified" interrogators. The first of these proposals was obviously unsatisfactory as the number of prisoner medical officers was too small to require the full time of an officer. Other demands upon the time and ability of the officer in question were too great to permit his full-time release to G-2 for this purpose, especially without any possibility of obtaining an equally skilled replacement. The second proposal was equally unsatisfactory in view of the obvious absurdity of expecting that valuable technical information would be obtained by a nontechnically trained interrogator who could do nothing more than record the answers

⁷⁶ Memorandum, Lt. Col. Gaylord W. Anderson, MC, Director, Medical Intelligence Division, Surgeon General's Office, for Director, Preventive Medicine Division, 3 Feb. 1944, subject: Report of the Medical Intelligence Division for the Period 16 Jan. 1944 to 31 Jan. 1944.

to written questions which he himself failed to understand. Subsequent use of this procedure in dealing with certain special situations confirmed the suspicion that the medical information so obtained was not only valueless but even grossly inaccurate in many respects.

At a conference arranged on 25 February 1944, through the Joint Chiefs of Staff, it was agreed that, after a 1-month period of "indoctrination," a medical intelligence officer might interview prisoners.⁷⁷ Capt. Carlo Henze, MC, an Austrian by birth and formerly on the medical faculty of the University of Innsbruck, was detailed to this assignment. The month of indoctrination was spent in routine interviews; only a few of the interviews pertained to medicine. Captain Henze was then accepted by G-2 as qualified for this work and, for the next few months, interviewed a number of prisoners. These interviews yielded information of material value and provided a means of obtaining quickly the answers to many specific questions as required.

Unfortunately, similar arrangements were never completed with respect to interrogation of Japanese personnel, but too few medical personnel ever reached the United States to warrant making an issue of the problem. On several occasions, medical intelligence informally expressed its desire to have a member of its staff interview certain Japanese prisoners, but G-2 never consented. Each time this request was received with a polite offer to have "qualified" interrogators put appropriate questions to these prisoners. After a few experiences which showed that the answers obtained were either incomplete or confusing, medical intelligence declined to submit further questions.

In the meantime, the Captured Personnel and Materiel Branch (formerly the Prisoner of War Branch) of G-2 made available all medical information which it received. Yet, the bits of information gleaned from interviews by nontechnically trained personnel served only to heighten the conviction that interviews, to be of value, must be conducted by personnel who understand the topic under discussion and are therefore in a position to depart from form questions and to pursue leads suggested by the answers obtained. The branch was equally assiduous in arranging for interviews of U.S. personnel who had escaped or been released from enemy prison camps.

Overseas, the policy with respect to interrogation of prisoners was less rigid. Unfortunately, in these areas medical intelligence personnel possessing adequate linguistic capacity were not available, until late in the war, in connection with the Combined Intelligence Objectives Subcommittee and the Also's Mission of G-2. Except in the European theater where such investigators carried on extensive interviews,⁷⁸ in Central Pacific (later

⁷⁷ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Chief, Preventive Medicine Service, 26 Feb. 1944, subject: Meetings Attended During Week Ending 26 Feb. 1944.

⁷⁸ Report, Maj. Harold M. Horack, MC, 1 Sept. 1945, subject: Medical Department Participation in the Combined Intelligence Objectives Subcommittee Program and Related Technical Intelligence Activities.

Pacific Ocean Areas), where some interrogation was carried on by enemy equipment collection team personnel through the medium of interpreters on Saipan and Okinawa and in prison camps in Hawaii, and in Southwest Pacific, where members of the 5250th Technical Intelligence Composite Company participated in questioning, no attempt appears to have been made to interview captured medical personnel other than the routine interrogation carried out under G-2 auspices. If medical intelligence officers with adequate linguistic capacity had been present on the staff of each theater surgeon, undoubtedly much valuable information could have been obtained through such interviews.

Overseas Collection

As medical intelligence was established to assemble data about foreign areas, it was logical to attempt to provide for the orderly flow of intelligence from overseas sources in nonenemy countries. The surveys of defense bases had shown the value of overseas visits and inspections. As the war progressed, information on Allied medical experience and on enemy-held areas frequently became available in the theaters, which information might not reach Washington unless a formal plan for its collection could be evolved.

This need for orderly overseas collection of medical intelligence from nonenemy countries was realized soon after establishment of the subdivision. Accordingly, contacts were made with G-2 and with the Office of Naval Intelligence to provide for alerting military and naval attachés regarding the collection of information on medical subjects. Outlines and questionnaires were prepared for use by such attachés. In many instances, these yielded extremely valuable data. Later, medical intelligence participated in the formal instruction of all G-2 personnel preparing for overseas assignment; thus, such persons were alerted to the value of collecting items of medical interest.⁷⁹ The data returned by such attachés and observers were of such value as to show conclusively that a well-trained layman can assemble certain types of data, if properly instructed.⁸⁰ This does not mean that a medically trained observer cannot assemble more valuable data but rather that, lacking suitable technical observers, full use should be made of all types of personnel on overseas assignments. The real weakness of such an arrangement during the war was that, too often, it covered areas of least vital importance to the war effort. The method was, however,

⁷⁹ Memorandum, Lt. Col. Tom F. Wayne, MC, for the Director, Preventive Medicine Division, Surgeon General's Office, 2 Dec. 1942, subject: Report of the Medical Intelligence Branch, Preventive Medicine Division, for the Period 16 Nov. 1942 to 30 Nov. 1942, Inclusive.

⁸⁰ Data on health organization, vital statistics, medical and hospital facilities, water supplies, and sewage disposal facilities were collected very satisfactorily by laymen, but information on disease prevalence and on fauna and flora was usually lacking in the requisite detail unless assembled by personnel with some understanding of the epidemiological importance of the data. Either type of observer can collect local documents, reports, and other publications.

shown to be of potential value in the collection of postwar medical intelligence.

The collection of information on combat areas required a higher degree of technical knowledge on the part of the observer. The need was for technically trained personnel who, by their own observations and coupled with selective interviews of Allied personnel or of prisoners of war, might obtain highly valuable information on medical problems and experiences of cobelligerent and foe alike. G-2 had assigned such personnel as Capt. (later Lt. Col.) William S. Moore, MC, in Egypt, and Maj. (later Col.) Earle M. Rice, MC, in India, though not with the express purpose of obtaining medical intelligence. The extremely valuable reports emanating from these two sources showed clearly the value of qualified medical personnel as overseas observers.

Military Attaché for Medicine

The first formal step in the establishment of a group of overseas medical intelligence observers was taken in March 1943 when Colonel Whayne, then chief of Medical Intelligence, was transferred to G-2 for assignment as Assistant Military Attaché for Medicine at the American Embassy in London.⁸¹ During the year that Colonel Whayne continued on this assignment, he clearly demonstrated the value of the position through the collection of valuable information, available only in London where contacts might be maintained with the British Government and the various governments in exile. This position as Assistant Military Attaché for Medicine was maintained throughout the war, the position being filled successively by Maj. (later Lt. Col.) David M. Greeley, MC, and Maj. Sarah H. Bowditch, MC, both of whom provided an orderly flow of valuable data through the attaché reports to G-2.

Joint Intelligence Collecting Agencies

In the summer of 1943, G-2 developed a plan for joint Army-Navy teams, known as Joint Intelligence Collecting Agencies, to be assigned to certain theater headquarters for the collection of intelligence comparable to that gathered in various countries by the military and naval attachés. The Surgeon General requested assignment of suitably qualified medical officers to such teams and specified informally the desirability of assignment to teams going to the North African theater and to the China-Burma-India theater. The only other JICA teams were being dispatched to the Middle East where the presence of Colonel Moore, as military attaché, made the assignment of a medical officer to JICA superfluous. Decision on this request was left to the commanding officer of each team.⁸² The officer in

⁸¹ See footnote 30, p. 262.

⁸² (1) Letter, Deputy Surgeon General, to Commanding General, Army Service Forces, 21 July 1943, subject: Medical Officers for J.I.C.A. Groups, with 2d indorsement, 3 Aug. 1943, and 5th indorsement, 14 Aug. 1943. (2) See footnote 57, p. 270.

charge of the North African team first accepted and then refused the request on the ground that he wished his entire staff to be made up of "generalists" capable of collecting all types of intelligence.⁸³ The result was that the rare medical item contained in JICA reports from that theater was such as might have been obtained from a Baedeker guide or a medical text; nothing of value medically was ever received from that team.⁸⁴ That information was available but neglected or missed was well demonstrated by the extremely valuable information obtained by Office of Strategic Services medical operatives and sent to the theater headquarters.

By contrast, the commanding officer of the JICA from the China-Burma-India theater welcomed a medical intelligence officer on a trial basis.⁸⁵ Accordingly, Maj. (later Lt. Col.) Paul R. Slater, MC, of the medical intelligence staff was assigned on temporary duty with this team but was carried on the medical intelligence allotment from September 1943 to March 1944.⁸⁶ During this period, Major Slater not only forwarded reports of great value to medical intelligence but also became so valuable to JICA that he was taken over on G-2 allotment and was provided an assistant, Capt. (later Maj.) Leonard V. Short, MC, who, after the division of the theater into the India-Burma and China Theaters, respectively, remained to cover the former, while Colonel Slater went on to China.

Theater medical intelligence officer

A medical intelligence officer, Lt. Col. William A. Howard, MC, had been dispatched in September 1943 for assignment to the Office of the Chief Surgeon, ETOUSA.⁸⁷ Although this position became of great value to the office of the theater surgeon, it turned out to be of less value to the War Department as a source for collection of overseas intelligence than was that of the military attaché or the JICA, owing to the difficulties of return of information through formal command channels. So long as the headquarters remained in London, information collected through the theater could be relayed via the Assistant Military Attaché for Medicine, but this channel could not be utilized to any extent after the headquarters moved to the Continent.

In this part of the program, Colonel Howard was doubtless at a serious disadvantage because of the fact the position was carried as part of the Operations Division, War Department General Staff, and had its work

⁸³ Letter, Maj. Gen. George F. Lull, Deputy Surgeon General, to Commanding General, Army Service Forces, 14 Oct. 1943, subject: Assignment of Lt. Col. Sanford V. Larkey, MC, to Headquarters, Commanding General, North African Theater of Operations, for Service in the Joint Intelligence Collecting Agency in Algiers.

⁸⁴ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Lt. Col. John P. Cranwell, MC, 29 Dec. 1943, subject: J.I.C.A. Technical Study of the Terrain-Northern Italy.

⁸⁵ See footnote 82, p. 283.

⁸⁶ (1) Letter, Deputy Surgeon General, to Commanding General, Army Service Forces, 21 July 1943, subject: Medical Officers for J.I.C.A. Groups, with 6th indorsement thereto, 31 Aug. 1943. (2) Memorandum, Lt. Col. Gaylord W. Anderson, MC, for the Chief, Preventive Medicine Service, 15 Mar. 1944, subject: Report of the Medical Intelligence Division for the Period From 1 Mar. to 15 Mar. 1944.

⁸⁷ See footnote 56, p. 270. (A second officer was added in January 1945.)

keyed entirely to the operational program. Thus, so much of his time was required in maintaining liaison between the Office of the Chief Surgeon and theater G-2 as to operational developments that little opportunity remained for development of the contacts required for the active collection and regular flow of intelligence of a purely medical character. On the other hand, the medical problems across the line of battle in the European theater presented fewer unknown factors than was the case in the Pacific Ocean Areas. There was thus, perhaps, less need in this theater for the developments of an active medical intelligence collection program than in other theaters of operations. In addition to the strictly theater functions, which it apparently served to the complete satisfaction of the chief surgeon, the position served as an invaluable nucleus on which could be built the Combined Intelligence Objectives Subcommittee and enemy equipment collection programs which were later developed. If one may judge from this single, but probably fairly typical, example of the relative merits of assignment of medical intelligence officers to formal intelligence agencies, as contrasted with assignment to the office of the theater surgeon, one must conclude that the former produces a more abundant flow of information to the War Department, and that the value of the theater officer is to the theater itself, to whose interests and needs he must properly devote his energies and attention.

None of the other theaters created a comparable medical intelligence program as part of the Office of the Chief Surgeon. In November 1943, The Surgeon General had twice recommended that a medical intelligence officer be assigned to the staff of each theater surgeon, but the recommendations were blocked by ASF intelligence⁸⁸ and by Operations Division⁸⁹ as the plan was considered in conflict with the still-nebulous programs for dispatching enemy equipment collection teams. These teams were finally authorized in February 1944 but, because of lack of personnel allotments, they did not actually depart until the middle of 1944. Although these had value, they did not take the place of medical intelligence officers attached to the theater staff.

In the SWPA (Southwest Pacific Area), some of the functions of such an officer were apparently performed with a high degree of skill by medical officers attached to the 5250th Technical Intelligence Composite Company, a unit operating under theater G-2 and comprising personnel representing all the technical services.⁹⁰ The medical section of this, under Maj. Talcott

⁸⁸ (1) Letter, The Surgeon General, to Commanding General, Army Service Forces (through Director of Intelligence, Army Service Forces), 9 Nov. 1943, subject: Overseas Collection of Medical Intelligence, with 1st indorsement from Deputy Director of Intelligence to The Surgeon General, 29 Nov. 1943. (2) Memorandum, The Surgeon General, for the Secretary, General Staff, 22 Nov. 1943, subject: WRS Report and Recommendations Regarding Medical and BW Intelligence.

⁸⁹ Memorandum, Acting Assistant Chief of Staff, for the Secretary, General Staff, 26 Nov. 1943, subject: WRS Report and Recommendations Regarding Medical and BW Intelligence.

⁹⁰ Technical Intelligence Organization and Functions, TI No. 1, Headquarters, United States Army Services of Supply, Southwest Pacific Area, Office of the Assistant Chief of Staff, G-2, 5250th Technical Intelligence Composite Company, Separate (Provisional).

Wainwright, MC, participated in the Hollandia landing and subsequent military operations.⁹¹ It would appear, however, that its activities and subsequent military operations centered on enemy equipment, though some information appears to have been assembled about medical and sanitary hazards incidental to the operations. The unit does not appear to have been in a position to assemble and appraise information as to potential medical hazards of future operations or to advise the office of the theater surgeon with respect to these hazards. If such an activity was a part of its duties, the fact is carefully concealed in its report of activities.

Thus, it would appear that in the Southwest Pacific Area, as well as in other theaters except the European, the collection of medical intelligence as a step in the planning of medical participation in future operations was not specifically assigned to any one office. Probably the preventive medicine officer in the theater was most responsible for this work, if any was done. That a need was felt for this sort of help is suggested by the fact that the requests for personnel for the newly created U.S. Army Forces, Pacific, headquarters planning for the invasion of Japan, included a request for a medical intelligence officer. The sudden collapse of Japan before the headquarters was fully established resulted in a revision of personnel requests. Personnel suitably qualified for medical intelligence, such as Colonel Moore, had already been dispatched to the theater on a somewhat different assignment and after the surrender were utilized for intelligence activities with respect to Japanese medical research.⁹²

Enemy equipment collection teams

These teams, modeled upon teams established early in the war by the Chief of Ordnance, appear to have been originated by ASF headquarters. Although Army regulations specifically provide in War Department Circular No. 104, published on 13 March 1944, for the collection and return of captured equipment for intelligence purposes, field experience has shown that this equipment is not returned unless the technical services send personnel to collect it. The theater staff has a primary concern in operations against the enemy, but little in the problem of developing equipment. Furthermore, the souvenir-hunting instinct of the average American is so distressingly well developed that many of the most interesting and significant items failed to be included in the few meager shipments made under theater auspices.

As an excellent equipment intelligence program had been developed by the Ordnance Department, Army Service Forces apparently considered that an identical program would be of value to all the technical services and

⁹¹ Letter, Maj. Talcott Wainwright, MC, 5250th Technical Intelligence Composite Company, Separate (Provisional), Medical Section, to the Chief Surgeon, United States Army Services of Supply, 1 July 1944, subject: Medical Technical Intelligence of Hollandia.

⁹² Office Order No. 4, Chief Surgeon's Office, U.S. Army Forces, Pacific, 22 Aug. 1945.

ordered its establishment.⁹³ Under the program as conceived by Army Service Forces, teams representing each of the technical services were to be dispatched under its auspices to each theater where they would be attached to G-2 for administrative purposes; would exercise no theater functions; and would confine themselves to collection and study of enemy equipment for dispatch to the Zone of Interior for further testing and study as a means of developing suitable countermeasures or defensive equipment. The plan was formally accepted by the various theaters, but there is no evidence that within the theaters the chiefs of the various technical services were necessarily acquainted with the proposal.

At the outset of the program, the Surgeon General's Office pointed out that the need for such a program and the value of it were different in the field of medicine than in the field of ordnance.⁹⁴ Detailed knowledge of enemy guns and tanks is essential in operational planning as well as in the development of suitable defensive or counteroffensive weapons. Yet, the fact that the enemy has a better litter or portable X-ray machine does not require the modification of Medical Department equipment. Under the circumstances, the Surgeon General's Office indicated that while such collection teams would be of value as means of ultimate improvement of U.S. equipment, they did not replace the need for overseas observers in other aspects of medical intelligence. Under date of 17 February 1944, The Surgeon General was ordered to provide one officer for each team.⁹⁵ As a result of informal conference, it was agreed that, inasmuch as the officer was representing The Surgeon General, he would be free to gather whatever type of additional information might be desired by The Surgeon General. This latter turned out to be an empty promise that could not be made good because of theater policies with respect to such teams. It was certainly, however, the understanding upon which personnel were selected and dispatched.

The dispatch of personnel on such teams was delayed until the middle of 1944.⁹⁶ The original directive called for dispatch of personnel out of existing allotments for installations under the direct control of the chiefs of the technical services. From the standpoint of the Medical Department, this would have meant diverting personnel from already understaffed offices to functions of less value to the department. Ultimately, a special allotment of six officers (three majors and three captains) was obtained and assigned to the Medical Field Service School at Carlisle Barracks, Pa., for administrative purposes. Because of the shortage of medical officers, it

⁹³ (1) Letter, Lt. Gen. Brehon B. Somervell, Commanding General, Army Service Forces, to Commanding General, United States Army Forces in the European Theater of Operations, 14 Mar. 1944, subject: Enemy Equipment Intelligence Service Teams. A similar letter went to other theaters. (2) See footnote 62 (1), p. 271.

⁹⁴ Letter, Commanding General, Army Service Forces, to The Surgeon General, with 1st indorsement thereto, 3 Feb. 1944, subject: ASF Enemy Equipment Intelligence Service Teams.

⁹⁵ See footnote 62 (2), p. 271.

⁹⁶ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for the Chief, Preventive Medicine Division, 31 May 1944, subject: Report of the Medical Intelligence Division for the Period 16 May 1944 to 31 May 1944.

was agreed that only Sanitary Corps or Medical Administrative Corps personnel would be used.⁹⁷ The nature of the project, and the lack of a feeling of real need for it by those parts of the Medical Department responsible for development of equipment, precluded the possibility of obtaining personnel with an appropriate background which would qualify them to make expert field examination and appraisal of equipment. Furthermore, the assurance from Army Service Forces that such personnel might be used to collect other types of overseas medical intelligence was interpreted as calling for selection of personnel picked chiefly for the latter role.

Four Sanitary Corps officers⁹⁸ were accordingly selected and, after a brief period of indoctrination in the Medical Intelligence Branch and the Field Equipment Laboratory at Carlisle Barracks, were dispatched to the European theater, the North African (later Mediterranean) theater, the Southwest Pacific Area, and the Central Pacific Area. The South Pacific Area had in the meantime become inactive, and the Chief Surgeon, China-Burma-India theater, had indicated that, until such time as more captured Japanese medical materiel was available, there was no need for Medical Department representation on the team in that theater.⁹⁹ Early in 1945, in response to a specific request, such an officer was ultimately dispatched to the India-Burma Theater.¹⁰⁰

The operation and success of the program in the various theaters was extremely varied, depending chiefly on the manner in which the personnel was handled and the ingenuity of the officer in question. No two theaters interpreted the plan alike; it was so modified as to bear little resemblance to its original pattern.

European theater.—In the European theater,¹⁰¹ the ASFEEIST (Army Service Forces Enemy Equipment Intelligence Service Team) never functioned as a unit as the individual members were assigned on temporary duty to the offices of the chiefs of the respective technical services for whatever use or direction was desired. The Chief Surgeon had not been advised of the project before the arrival of an officer, Maj. Meyer J. Plishner, SnC, for this purpose. Necessary equipment which the theater had presumably agreed to furnish was not forthcoming. After many difficulties, this officer was permitted to operate more or less independently. Although furnished invaluable assistance by the staff of the Chief Surgeon, his program was never looked upon as an integral part of the theater program, nor did it have even the remotest connection with the theater G-2. His

⁹⁷ See footnote 86 (2), p. 284.

⁹⁸ Maj. Meyer J. Plishner, SnC, for ETOUSA; Capt. Russell W. Cumley, SnC, for NATOUSA; Capt. Robert G. Gould, SnC, for POA; Capt. Frederick B. Thompson, Jr., SnC, for SWPA. (Captain Thompson was later replaced by Maj. Oney C. Raines, Jr., MC.)

⁹⁹ Personal conference with the Chief Surgeon, China-Burma-India theater.

¹⁰⁰ Memorandum, Col. H. R. Kibler, GSC, Executive Officer, Intelligence Division, Army Service Forces, for The Surgeon General, 27 Jan. 1945, subject: Procurement of Medical Officer for India-Burma Theater. (Capt. Jacob L. Rohrbaugh, SnC, was later dispatched on this assignment.)

¹⁰¹ Letter, Maj. Meyer J. Plishner, SnC, ASFEEIST (Medical), to The Surgeon General, 7 Nov. 1945, subject: Activities of the ASF Enemy Equipment Intelligence Service Team (Medical), ETO.

activities were limited to the collection and shipment of captured equipment; the opportunity to collect and dispatch other types of medical intelligence, for which he had been briefed and which could not come through the usual theater channels, was denied to him. After a period of 4 months of experimentation, during which the difficulties and limitations of this type of operation became fully apparent, Major Plishner, with the approval of the Chief Surgeon, ETOUSA, returned temporarily to the United States to present a plan for an enlarged program designed to assure the return of samples of all enemy items in the German medical supply catalog and to provide for preliminary study and appraisal in the field by laboratory personnel trained in this type of work.¹⁰² In somewhat modified form, this plan was incorporated in the CIOS (Combined Intelligence Objectives Subcommittee) program that was later evolved for collection of information about German wartime research and development.¹⁰³

Under this new pattern, the efficiency of the program was greatly increased for additional personnel were now available who were familiar with the development of equipment and were thus prepared to make preliminary field examinations and appraisals. Laboratory facilities were also provided in the theater as part of the CIOS project. During the first half of 1945, a tremendous amount of captured materiel had been shipped to the Field Equipment Laboratory with the result that this laboratory obtained samples of almost all German medical equipment. If this equipment collection program in the European theater had not been incorporated as part of the CIOS project, its accomplishments would doubtless have been far less, as a single officer, operating essentially on an independent basis in a huge theater, can accomplish but little. By the middle of 1945, the collection mission was completed, and Major Plishner was recalled to Carlisle Barracks to share in the analysis of the collected materiel.

North African (Mediterranean) theater.—In the North African (Mediterranean) theater,¹⁰⁴ the ASFEEIST operated as a unit under G-2 as originally planned but in close relationship with the Office of the Chief Surgeon so far as concerned the Medical Department representative. This office appears to have had little sympathy with the project, as with other parts of the medical intelligence program, and insisted on clearing all data returned to the Zone of Interior. This attitude of tolerant forbearance was possibly conditioned in part by the fact that the collection team was not in a position to provide those items of medical intelligence that the theater felt it needed and which were being provided by the medical representatives of the Office of Strategic Services who had developed in

¹⁰² Memorandum, Maj. Meyer J. Plishner, SnC, for Lt. Col. Gaylord W. Anderson, MC, Director, Medical Intelligence Division, Surgeon General's Office, 16 Dec. 1944, subject: Activities of the Enemy Equipment Intelligence Team (Medical Department, ETO).

¹⁰³ Report, Col. Roger G. Prentiss, Jr., MC, Col. Howard F. Currie, MC, and Lt. Col. Gaylord W. Anderson, MC, to The Surgeon General, 6 Feb. 1945, subject: CIOS.

¹⁰⁴ Letter, Capt. Russell W. Cumley, SnC, Headquarters, Medical Field Service School, Carlisle Barracks, Pa., to The Surgeon General, 10 Sept. 1945, subject: The Enemy Equipment Intelligence Service Team (Medical) in the Mediterranean Theater of Operations, August 1944–August 1945.

this theater a highly competent and valuable program for the collection of medical information from behind enemy lines. Under the circumstances, the enemy collection program paled in comparison. Yet, it cannot be overlooked that the program did yield valuable information but more in the field of documentary intelligence than in that of equipment.

Central Pacific Area.—In the Central Pacific Area also, the ASFEEIST operated as a unit under G-2 direction but with little official relationship to the offices of the chiefs of the respective technical services. Whatever relationship was established was on the initiative of the individual team members. In the field of medicine, good relationships were established which were mutually beneficial. The Medical Department representative was accorded a free rein to gather and return such information and equipment as seemed to him to be of maximum value to the War Department. A rather limited amount of materiel was selected and shipped, but extremely valuable data in the field of general medical intelligence were obtained. The team participated in the Saipan, Guam, Iwo Jima, and Okinawa operations, in all of which it gathered valuable data on Japanese medical practices, problems, and materiel. Furthermore, it provided a prompt check of the accuracy of the medical intelligence surveys of these areas, a check which was invaluable in appraising the reliability of sources used in the preparation of these reports.¹⁰⁵

Such a check was essential as many of these same sources had been used in preparation of surveys of Japan itself; if they were unreliable with respect to the island possessions, their reliability with respect to the home islands could be questioned. These checks not only verified the accuracy of the sources but also added many important items to fill the gaps in the surveys. As a result, information about these relatively unknown islands suddenly grew to the point where it was more comprehensive than for many previously well-studied areas. The team member also participated in interviews of Japanese medical prisoners, an arrangement not achieved in any other theater. Considering the relative achievements of the teams in the several theaters, the yield of information doubtless was greatest from the Pacific Ocean Area. This was due in part to the mode of operation of the team, the sympathetic direction, the quality of the Medical Department representative, and the close relationship to the Joint Intelligence Center, Pacific Ocean Areas. With the absorption of the Pacific Ocean Areas into the new Pacific theater after the Philippine and Okinawa Campaigns, the equipment team was placed in a subordinate position which would have doomed it to ineffectiveness.¹⁰⁶ Immediately after the collapse of Japan, the Medical Department representative was accordingly recalled, as his potential usefulness was felt to be at an end.

¹⁰⁵ Letter, Capt. Robert G. Gould, SnC, ASFEEIST, to Surgeon General's Office, 31 Oct. 1944, subject: Information concerning Saipan and Guam with reference to TB MED 20.

¹⁰⁶ Letter, Capt. Robert G. Gould, SnC, ASFEEIST, to The Surgeon General, 11 Aug. 1945, subject: Termination of ASFEEIST Activities in MidPac.

Southwest Pacific Area.—The enemy equipment team sent to the Southwest Pacific Area was absorbed into the larger, already established, 5250th Technical Intelligence Composite Company, and thus both disappeared from view and ceased to be of value to the War Department. No reports or information were received other than the purely perfunctory monthly reports of the 5250th, listing items of equipment found in various operations. A bottle of aspirin, the sole medical item listed in one not too atypical report, has very little intelligence value. Almost no items of equipment were returned. Thus, from the standpoint of the Medical Department, the program in this theater was of no value whatsoever, though it is hoped that the officer sent to the theater, and charged against the Surgeon General's Office, may have been of some value to the operations of the 5250th Technical Intelligence Composite Company. The medical information and equipment received in Washington from this company were inconsequential except for the excellent report on equipment captured at Hollandia and the handbook on Japanese drugs.¹⁰⁷

India-Burma Theater.—Before the assignment of an officer to the theater, the enemy equipment collection team in China-Burma-India theater¹⁰⁸ had operated without Medical Department representation, since medical officers on the Joint Intelligence Collecting Agency team had collected and shipped the few samples of Japanese equipment that reached American or British hands. Ultimately, an officer, specially trained in equipment, was attached to the team when operations in Burma were bringing a fair amount of materiel to light.¹⁰⁹ Almost no information, however, was relayed to Washington, or was much materiel returned. The sudden cessation of the war interrupted that part of the program which promised to be the most productive—that of attachment to the forces scheduled to invade Malaya.

Combined Intelligence Objectives Subcommittee and Technical Industrial Intelligence Committee

Although examination of captured medical materiel and interview of selected personnel revealed certain aspects of enemy medical developments, they failed to reveal the full extent of research or the details of technologic progress. There remained an obvious need for firsthand investigation of medical progress in universities, research institutes, and industry—an investigation which could be carried out concomitant with the occupation of enemy territory or which could be delayed until after surrender. The former plan, based on the promise of a somewhat slow conquest, offered

¹⁰⁷ (1) See footnote 91, p. 286. (2) Enemy Materiel, Medical, Japanese Drugs and Medicines, Medical No. 1, Headquarters, United States Army Services of Supply, Southwest Pacific Area, Office of the Assistant Chief of Staff, G-2, 5250th Technical Intelligence Composite Company, Separate (Provisional), Medical Section.

¹⁰⁸ Enemy Equipment Intelligence Service, Medical Section, Field Laboratory, India-Burma Theater. Japanese Army Medical Materiel Composite Technical Reports. Volume 1.

¹⁰⁹ See footnote 100, p. 288.

the advantage of making information available for use and possible exploitation during the course of hostilities. Yet, unless such investigations should reveal enemy preparations for the use of bacteriologic or gas warfare, there appeared to be little likelihood that medical information so discovered would alter the basic pattern of Medical Department procedures. The results of such a program of intelligence were, therefore, of greater potential importance for medical research and for the drug and medical supply industry than for the operation of the Medical Departments of the Armed Forces.

It was thus inevitable that the chief impulse for such investigations should have come from parts of the War Department which were interested in the collection of intelligence in technical fields to which such information would be of far greater significance than to medicine. When this project was first broached to the Surgeon General's Office, some lack of interest was to be expected. In May 1944, request was made by G-2 through ASF intelligence¹¹⁰ for an officer who would be part of a special overseas mission to gather information regarding enemy medical research, a single officer to be charged with the duty of personally collecting information on all phases of medical progress. In reply, The Surgeon General suggested that the Committee on Medical Research of the Office of Scientific Research and Development be requested to make a suitably qualified investigator available as this body had been established for the express purpose of coordinating and promoting medical research. For reasons best known to itself, G-2 did not make any such request to this committee for assistance. The Surgeon General was, however, asked for a list of topics on which information might be desired. Such a list was furnished, but no promise was made for the assignment of investigators.

In the meantime, extensive plans were being formulated in London for the development of a joint British-American operation for collection of such information under the auspices of the Combined Intelligence Objectives Subcommittee. In the medical planning for such an operation, the theater medical intelligence officer represented the Chief Surgeon while the London representative of the Committee on Medical Research represented his parent committee; the Navy was also suitably represented. No information on such developments was transmitted to the Surgeon General's Office until November 1944, nor was request made for assistance until late January 1945. Further personnel were requested under date of 7 February 1945.

In October 1944, however, the Commanding General, Army Service Forces, apparently informed of these developments in London and certainly aware of the G-2 plans, began to formulate measures for active representation of the technical services in these enterprises. At the request of

¹¹⁰ Memorandum, Col. J. M. Roamer, MC, Director of Intelligence, Army Service Forces, for the Chiefs, Technical Services, 17 May 1944, subject: Collection of Scientific Intelligence, with 1st indorsement, The Surgeon General to Commanding General, Army Service Forces (attention: Director of Intelligence), 25 May 1944.

G-2, the technical services were directed ¹¹¹ to prepare a list of all possible "targets" in Germany that should be subjected to investigation after capture, the items to be learned from such investigations, and estimates of personnel required. Such information within the field of medicine was assembled by medical intelligence. The directive in question made it clear that estimates were desired in terms of complete collection of data, not merely data of immediate military significance.

On the basis of these estimates, and without knowledge of the technical services, Army Service Forces requested permission of the theater commander ¹¹² to attach a staff of special investigators to the office of the chief of each technical service in the theater on temporary duty for collection of this information, a plan certainly not envisioned by the technical services at the time of submission of targets and estimates. Permission for such assignment was obtained, though the theater stressed the fact that it could neither equip nor service these investigators. On the basis of this acceptance by the theater, The Surgeon General was directed to dispatch at once 60 military or civilian special investigators, a staff almost as large as that already assigned to the Office of the Chief Surgeon, ETOUSA. No special allotment was provided for such personnel. As such a venture represented obvious lack of coordination between the theater and the War Department, permission was obtained to send a board of three officers to the European theater to formulate a suitable plan for the collection of this type of medical intelligence.¹¹³

In the meantime, the Joint Chiefs of Staff had similarly formulated a plan for the collection of technical intelligence on subjects of interest to nonmilitary governmental agencies and to industry.¹¹⁴ This apparent duplication of effort was based on the assumption that CIOS interests were to be limited to matters of immediate military significance while those of the Joint Chiefs of Staff agency—TIIC (Technical Industrial Intelligence Committee)—were to embrace items of scientific and industrial developments apart from the military. In accordance with this plan, a medical subcommittee of TIIC was created to plan for the collection of medical intelligence. Although the War Department was represented on this committee, this representation was chosen from outside, and without the knowledge of, the Surgeon General's Office. Since The Surgeon General had already been directed by Army Service Forces to proceed with the collection

¹¹¹ Memorandum, Assistant Chief of Staff, G-2, for Director of Intelligence, Army Service Forces, 24 Oct. 1944, subject: Intelligence Exploitation of German Surrender, with 1st indorsement, The Surgeon General to the Commanding General, Army Service Forces (attention: Director of Intelligence), 3 Nov. 1944, and two inclosures thereto: Medical Department Targets for Collection of Scientific Intelligence in Medicine, 3 Nov. 1944, subject: Personnel Analysis, Collections of Scientific Intelligence in Medicine, and Targets.

¹¹² War Department cable WAR-68694, 26 Nov. 1944.

¹¹³ Memorandum, Col. J. M. Roamer, MC, Director of Intelligence, Army Service Forces, for The Surgeon General (attention: Lt. Col. G. W. Anderson, MC), 30 Nov. 1944, subject: CIOS Investigators, with 1st indorsement, The Surgeon General to the Commanding General, Army Service Forces, 22 Dec. 1944.

¹¹⁴ Basic Directive, Technical Industrial Intelligence Committee, Annex to Appendix "B" to JCS 1105/1, Coordination of Requests Made on the Combined Intelligence Objective, 21 Oct. 1944.

of information on all items of medical science and technology, there was obvious overlapping of interests and duplication of efforts with full opportunities for dispute as to jurisdiction.

The theater commander, ETOUSA, had, meanwhile, directed that the chiefs of the technical services be responsible for operations to exploit captured territory for technical military intelligence, and had further directed that such work should be coordinated with the program of CIOS (Combined Intelligence Objectives Subcommittee).¹¹⁵ Both Army Service Forces and the Technical Industrial Intelligence Committee proposed to work through CIOS which, in turn, envisioned a separation of activities on the basis of targets which were or were not of primary military value.

The board of officers dispatched to the theater by The Surgeon General, in an attempt to straighten out these conflicts so far as they concerned the Medical Department,¹¹⁶ formulated a program in conjunction with the Office of the Chief Surgeon whereby full utilization would be made of technically qualified personnel already on duty in the theater, to be supplemented by personnel to be dispatched by The Surgeon General or TIIC for temporary duty. In accordance with this plan, three officers were immediately made available on temporary duty for administration of the program, and others dispatched as needed.

Two aspects of the planning were, however, never clarified either by ASF headquarters or by the TIIC planning committee, with resultant overlapping and confusion. The Chemical Warfare Service assumed responsibility for investigations of drug research on the grounds that drugs were chemicals and therefore within the sphere of interest of the Chemical Warfare Service, not of the Medical Department—a line of reasoning which, if extended to its ultimate conclusion, would have resulted in comparable encroachment upon all technical services. Confusion in the theater was avoided only by clearer thinking and understanding than was manifested in Washington. Comparable confusion was manifested by the TIIC Steering Committee in assigning to the technically unqualified Technical Committee of TIIC responsibility for investigations of X-ray developments and progress in measures for the treatment of water and sewage.

The Medical Subcommittee, TIIC, named the senior officer of this group, Col. Roger G. Prentiss, Jr., MC, as its representative in the theater.¹¹⁷ Through this arrangement, whereby the officer who represented the Chief Surgeon, ETOUSA, also represented the Medical Subcommittee of TIIC, duplication of effort and possible clash of interests were avoided. Upon request from the theater, TIIC dispatched investigators, if such were

¹¹⁵ Memorandum, the Adjutant General, European Theater of Operations, U.S. Army, for Chief Engineer, Chief Signal Officer, Chief Ordnance Officer, Chief Quartermaster, Chief Surgeon, Chief Chemical Warfare Officer, and Chief of Transportation, 20 Dec. 1944, subject: Technical Military Intelligence.

¹¹⁶ See footnote 103, p. 289.

¹¹⁷ (1) Memorandum, Steering Member, Medical Subcommittee, TIIC, for Executive Secretary, TIIC, 10 Feb. 1945, subject: TIIC Representative in London. (2) Letter, Acting Executive Secretary, Medical Subcommittee, TIIC, to The Surgeon General, 28 Feb. 1945, subject: Medical Subcommittee, TIIC, Representative in London, with 2d indorsement thereto, 23 Mar. 1945.

drawn from industry or educational institutions, whereas military officers and other governmental employees were dispatched by The Surgeon General. The latter were charged against a special allotment made available for this express purpose after The Surgeon General had opposed the original plan whereby such personnel were to be drawn from existing allotments. During the course of the CIOS-TIIC operations, 17 officers, 10 enlisted men, and one civilian investigator were furnished to the theater out of this allotment, while TIIC dispatched 14 civilian investigators. This group was supplemented by 13 officers and four enlisted men detailed by the theater to work on special investigations.¹¹⁸

Meanwhile, a workable plan of operations had been developed in the theater.¹¹⁹ A planning office in London cooperated with the British in selection of medical targets, choice of investigators, and mapping of operations. Personnel assigned to the Medical Intelligence Branch of the Office of the Chief Surgeon, ETOUSA, in Paris, were responsible for implementation of these plans. The program for collection of captured enemy equipment was fused with CIOS and strengthened by the availability of personnel capable of making preliminary field studies. Laboratory facilities, with four officers and two enlisted men, were provided at the 108th General Hospital.

The original plan of operation had called for a team, consisting of a German-speaking medical officer, an equipment officer, and a driver to be attached to the office of the surgeon of each of the four U.S. Armies operating in the European theater. It had been planned that such teams would make preliminary investigations of targets as they became available and would indicate the type of special investigators needed for detailed studies. Such teams were established and attached to the First, Third, Seventh, and Ninth U.S. Armies but did not achieve their maximum potential value owing to their late arrival in the theater and the sudden collapse of Germany, whereby an enormous number of potential targets became available in a short period of time. An advance control group of five officers and three enlisted men was attached to the office of the surgeon of the headquarters of Advance Section, Communications Zone, ETOUSA, and later to the office of the surgeon, 12th Army Group. This team, composed of Medical, Dental, and Sanitary Corps officers, was able to coordinate the work of the Army teams, assist special investigators and, at the same time, make a large number of independent investigations of a wide variety of targets.

Technical reports on Germany.—Reports on several hundred targets were prepared and submitted to the office in London where they were edited for publication as CIOS documents. Many of the supporting documents used in the preparation of the reports, but not incorporated in them, were returned to Washington. A large number of documents,

¹¹⁸ See footnote 78, p. 281.

¹¹⁹ *Ibid.*

including books, pamphlets, catalogs, copies of patent applications, and special descriptions of processes were obtained during the course of the investigations. Some that could not be forwarded in the original form were microfilmed or photostated and prints sent to Washington, either to the Medical Intelligence Division or to the office of the Medical Subcommittee, TIIC. In a few instances, the field investigators prepared supplemental reports after their return to the United States. These reports were submitted directly to Medical Intelligence Division or to TIIC and added to the collection of reports from the theater. A few supplemental reports were also prepared in medical intelligence on the basis of documentary material returned without analysis in the theater.

With the submission of the formal report on the investigations, the task of the theater was considered completed, and all special investigators were returned by 1 October 1945. A small group remained to care for miscellaneous supplemental investigations that were requested, but these requests were so few that all CIOS-TIIC personnel were returned to the United States by the end of 1945.

The third and last phase of the CIOS-TIIC project began with the arrival of the reports, documents, and various samples of equipment in the United States. The information collected could obviously be of no value unless it was disseminated to all interested parties. These included War Department agencies (the Navy Department had provided for independent collection of printed reports for its own use), research workers, and industry. To expedite availability of reports to the former, the Medical Intelligence Branch of the Office of the Chief Surgeon, ETOUSA, had forwarded carbon copies of all reports submitted by field teams and later forwarded copies of all printed reports. These were indexed and cataloged in the Medical Intelligence Division and circulated to various parts of the Medical Department in the same manner as were all other intelligence documents. Several attempts were made to make them available to research workers engaged on projects under the auspices of the Committee on Medical Research of the National Research Council but, with one or two notable exceptions, little interest was apparent.

This indifference was in striking contrast with the eagerness of industry to obtain access to these reports, an interest which could not be immediately satisfied as the reports were in all instances under security classification. Furthermore, release of a document to one company was not feasible until it could be made available to the entire industry. Thus, the reports and documents forwarded to the Medical Subcommittee, TIIC, could merely accumulate in that office until some decision had been made as to declassification and uniform and equitable distribution. The need for this was repeatedly pointed out by the Medical Subcommittee, TIIC, which was being importuned by the drug industry to release information on the findings in the field of drugs. In its insistence that this information

be released promptly, the drug industry properly pointed out that it had furnished many of the TIIC investigators and that British industry was already obtaining access to the documents in question.

Authority for release of information on American and enemy scientific and technologic developments had already been vested in the office of the Director of War Mobilization (later the Director of Reconversion) by Executive orders.¹²⁰ The War Department and TIIC were accordingly unable to take any action in this field until decisions had been made in accordance with these directives. Finally, and after many delays, the Director of Reconversion appointed an interdepartmental committee which detailed responsibility to the Committee on Publications of the Department of Commerce. This was done apparently on the theory that this Department was the logical agency to deal with American industry which was eager to apply the new knowledge. In accordance with this plan, all reports were to be turned over to the Committee on Publications which would prepare announcements in the form of abstracts for free distribution and would then reproduce all reports for sale on order.

In the meantime, all subcommittees of TIIC had been dissolved and the affairs of the Medical Subcommittee, TIIC, transferred to the Medical Intelligence Division in accordance with a policy of having the work of all subcommittees taken over by a permanent governmental agency. The Medical Intelligence Division thus came into possession of all medical documentary material.

American Drug Manufacturers Association.—The American Drug Manufacturers Association, justifiably impatient at the lack of decision which resulted in delays of release, had, in the meantime, evolved a project whereby it would assume financial responsibility for the reproduction of all medical reports, selling the same as a set at cost. A suitable sum had been appropriated by the association for this project and a committee appointed. The project was abandoned after conferences with the director of the Committee on Publications of the Department of Commerce, in the course of which assurance was given that the committee could and would provide for more rapid reproduction than could have been achieved by the association, an assurance that apparently could not be kept as shown by later events. Other factors influencing the decision to abandon the association's project were the feeling that delay of publication until all reports could be assembled as a set would cause needless delay in release of some of the earliest reports, the realization that many investigators or companies would not desire the complete set, and the apparent trend for certain commercial news agencies to exploit the delay by sale of brochures which were advertised as reports but amounted to mere announcements

¹²⁰ Executive Order No. 9568, 8 June 1945, as extended and amended by Executive Order No. 9604, 25 Aug. 1945.

that reports of a certain character were available in the Department of Commerce.¹²¹

The plan for release of all reports through the Department of Commerce entailed the preparation of abstracts by which the reports would be announced to libraries and to industry. The Medical Intelligence Division agreed to prepare these abstracts as the Department of Commerce was without medically trained abstractors. Accordingly, abstracts of all reports were prepared and, as rapidly as reports were declassified by the War Department, were forwarded to the Department of Commerce along with copies of the entire report. By the end of 1945, all but two or three delayed reports had been turned over to the Department of Commerce in form for release.¹²² A few supplemental reports, based upon assembly of documents which had not been subjected to careful scrutiny in the theater, were prepared. These included many pamphlets and reels of microfilm.

It was agreed that all original reports, documents, and microfilm, after reproduction, would be turned over by the Department of Commerce to the Army Medical Library for its permanent collection. All books, pamphlets, and other material, not incorporated in the CIOS-TIIC reports, were turned over directly to the Army Medical Library as the repository where they would be most readily available for study by all interested persons. With the transfer of all documents to either the Department of Commerce or the Army Medical Library, the CIOS-TIIC medical operations could be considered completed so far as concerned the military agencies. The final distribution to American science and industry remained a task for the Department of Commerce.

The account of the collection of scientific intelligence following the collapse of Germany would not be complete, however, without reference to certain documentary material collected by Office of Strategic Services representatives. The Office of Strategic Services was not prepared to send competent investigators for examinations of medical targets and was not included in the Medical Subcommittee, TIIC. The highly competent Office of Strategic Services medical team of the Mediterranean theater did, however, uncover much medical information in the form of books, pamphlets, doctoral theses, and some manuscripts. This material, forwarded to the Office of Strategic Services headquarters in Washington, was made available to Medical Intelligence Division and ultimately deposited with the Army Medical Library as a valuable supplement to the material gathered through CIOS-TIIC channels.

Japanese activities in medical sciences.—Early in 1945, and before the European CIOS-TIIC activities were in actual operation, preliminary

¹²¹ (1) Memorandum, Director, Medical Intelligence Division, Surgeon General's Office, for Chief, Preventive Medicine Service, Surgeon General's Office, 1 Oct. 1945, subject: Report of the Medical Intelligence Division for the Period 16 September 1945 to 30 September 1945. (2) Letter, Director, Medical Intelligence Division, to Dr. E. H. Volwiler, Abbott Laboratories, North Chicago, Ill., 26 Nov. 1945.

¹²² Memorandum, Director, Medical Intelligence Division, Surgeon General's Office, for Chief, Preventive Medicine Service, 26 Dec. 1945, subject: Report of Activities of Medical Intelligence and Health Education Division for the Month Ending 30 November 1945.

plans for a similar program in Japan, Formosa, Korea, and Manchuria were formulated in the War Department. In accordance with these plans, the Medical Intelligence Division furnished information about probable targets for investigation.¹²³ The plans for this operation were drastically modified before completion, with the result that the entire project was left as a theater responsibility. The Surgeon General was directed¹²⁴ to ascertain from the theater what technical personnel might be required for the completion of medical investigations. Although three investigators were originally requested, this request was later canceled and the entire investigation was carried on by theater military staff. The medical phase of the investigation was carried out under the Chief Surgeon, U.S. Army Forces, Pacific, by a small team known as the Committee for the Technical and Scientific Investigation of Japanese Activities in Medical Sciences and drawn from theater installations.¹²⁵

This committee, consisting of nine officers, headed by Colonel Moore, was established in Manila in August 1945, but its functions were limited to studies in Japan.¹²⁶ Operating through the Chief Surgeon's Office, Advance Echelon, Tokyo, the committee was instructed to "examine and evaluate Japanese installations and personalities associated with the medical sciences * * *" and to "correlate the activities of the medical section of the Enemy Equipment Intelligence Units * * *." Over a period of 3 months, representatives of the committee visited all cities of importance in medical education and all first-class medical institutions associated with research and developments in Japan. Thirty-two institutes or universities were visited, and over 200 persons interviewed.¹²⁷ Because of the magnitude of the task, the result of the operation could be considered little more than a screening. No attempt was made to prepare a critical analysis of the information. Thus the operation was solely one of collection. All documents, books, and pamphlets were shipped through the Joint Intelligence Center, Pacific Ocean Areas, to the Medical Intelligence Division, where, after preliminary screening, all material received was transferred to the Army Medical Library for custody. Samples of drugs, vaccines, and pathologic material were also shipped, but their ultimate disposition remains unknown.

Office of Strategic Services

Discussion of the collection program would not be complete without additional reference to the work of the Office of Strategic Services in

¹²³ Memorandum, The Surgeon General, for the Commanding General, Army Service Forces (attention: Director of Intelligence), 28 Mar. 1945, subject: List of Medical Targets in Japan.

¹²⁴ Letter, Col. J. M. Roamer, MC, Director of Intelligence, Army Service Forces, to The Surgeon General, 10 Aug. 1945, subject: Exploitation of Japanese Technology.

¹²⁵ Final Report of the Committee for the Technical and Scientific Investigation of Japanese Activities in Medical Sciences, Lt. Col. William S. Moore, MC, Chairman, to Chief Surgeon, U.S. Army Forces, Pacific, 5 Dec. 1945.

¹²⁶ See footnote 92, p. 286.

¹²⁷ See footnote 125, above.

obtaining information from foreign sources. This is not the place to discuss the details of either the domestic or overseas operations of this office; when released the history of the Office of Strategic Services will tell the full story. It should be recorded here, however, that the Medical Intelligence Division maintained close relationship with the Office of Strategic Services, helped outline its overseas program for collection of medical intelligence, and assisted in the briefing of some of its personnel and, in return, received much valuable information.

The basic aim of the overseas Office of Strategic Services operations appears to have been to introduce personnel behind enemy lines to furnish information on enemy operations, to disrupt communications, and to help organize the resistance forces. The most effective work was done in the North African theater and in the China-Burma-India theater. This was especially true in the field of medicine. The hazards of such operations were obviously great, so great, in fact, that a high return was required to warrant the risk entailed. It is doubtful if any item of medical intelligence was ever of such immediate tactical importance as to warrant a special operation of this character. Certainly, this was the case so long as the enemy showed no signs of imminent resort to gas or bacteriologic warfare. On the other hand, items of medical significance could be obtained incidental to other operations provided the personnel involved were properly alerted.

Of special value in this connection were certain medical officers who accompanied such expeditions to render medical care to the raiding personnel. The medical intelligence obtained through these sources was especially valuable in the Mediterranean theater, where, because of the excellence of the directing medical officer, the best program of this character was established. These personnel not only furnished information of value to the theater surgeon but also collected a substantial quantity of valuable documents for return to the United States where they were deposited in the Army Medical Library. Many of these documents were gathered after the surrender of Germany as part of an operation that largely overlapped and, to a certain degree, duplicated the CIOS program in southern Germany and Austria. The Office of Strategic Services medical program in the European theater was so small that it had been left out of consideration in planning the CIOS operation, with the result that little thought had been given to the possibility of coordination with the excellent Office of Strategic Services medical program in Italy.

In the China-Burma-India theater, some information was gleaned from Office of Strategic Services personnel who had operated behind the lines in Burma. Not all of these persons had, however, been briefed as to their possible role in medical intelligence, so that some of them had made no conscious effort to obtain such data. Early in 1945, medical personnel, especially briefed in Washington, were dispatched to the China Theater. They operated here for too short a period to obtain any quantity of valu-

able information. The presence of an excellent military observer for medicine attached to the Joint Intelligence Collecting Agency team also markedly reduced the need for an Office of Strategic Services medical intelligence program in this theater. Had the war lasted longer, valuable information would doubtless have been obtained.

ANALYSIS OF INTELLIGENCE AND PREPARATION OF SURVEYS

Although, for administrative purposes, an intelligence program may be separated into three components—collection, analysis, and dissemination—the dividing line between these is often indistinct. A good collection program can arrange for an orderly flow of information but can never supply all the detail that may be needed by the analyst. If a study is to bear any semblance of adequacy, the analyst must gather no small amount of supplemental information; in many instances, he must be the chief collector. To the extent that through his studies he is well versed in certain topics, he is often the one best equipped to share his knowledge—a dissemination function. So, while for ease of narration the history of medical intelligence follows these lines of separation, the operations themselves often of necessity overlapped, especially those of collection and analysis.

Surveys Prepared by Medical Intelligence Division

It has already been pointed out that studies of certain areas important to hemispheric defense preceded the formal establishment of a medical intelligence program. Some of these reports were little more than a 1- or 2-page statement of the most significant sanitary hazards. They could not be more comprehensive, for 52 reports were prepared in 28 days.¹²⁸ Considering the circumstances under which they were assembled, they contained an amazing amount of information. Prepared by engineers, they were limited almost entirely to a discussion of problems of environmental sanitation; diseases were largely ignored. The subsequent surveys of Newfoundland, Bermuda, and the Central American countries, in the fall and winter of 1940–41, showed the value of specific details.¹²⁹ The Fox-Banton surveys of early 1941 furnished more detailed information about the newly acquired defense bases.¹³⁰

By June 1941, when the Medical Intelligence Subdivision was formally established, the most immediate task appeared to be the preparation of surveys on all remaining parts of the defense pattern. The survey schedule of 1941, apparently based on the G–2 schedule for War Department Strategic Surveys, showed an attempt to achieve this goal: Antigua, Barbados, Bolivia, Montserrat, Nevis, Saint Christopher, and the Azores in August; Brazil, British Virgin Islands, French Guiana, and Mexico in September;

¹²⁸ See footnote 4, p. 254.

¹²⁹ See footnotes 5 and 6, p. 254; and 9, p. 255.

¹³⁰ See footnote 7, p. 255.

Guadeloupe and Martinique in October; Chile and Curaçao in December. On the other hand, some interest in the possibility of involvement in the European phase of the war was also apparent for a survey of Egypt had been prepared in July, and surveys of Eire (Ireland), Northern Ireland, French West Africa, Cape Verde Islands, and Iraq in October.¹³¹ Many of these early surveys dealt with the same areas covered by the Hardenbergh-Sweet reports of 1940 but were far more comprehensive in that they dealt more extensively with diseases and medical facilities. On the other hand, they failed to provide much additional information on environmental sanitation. The emphasis was thus shifted from environmental to disease problems, an apparent expression of the different interests of those responsible for the surveys.

The surveys of this period marked also a change in policy as to methods of preparation. Those of the hemispheric defense bases and of Central America had been based on actual visits to the areas. The current surveys and those of subsequent years were developed by library research, supplemented by such material as could be gathered from interviews with persons who had lived in the country in question. In a few instances, persons who had had experience in the country were employed, but in no instance could an investigator be dispatched to a country for the avowed purpose of gathering data. Library research and interviews thus became the foundations on which medical intelligence surveys were to be built.

Viewed in retrospect, this was possibly desirable, for no other means were at hand with respect to enemy-held areas which were later to constitute the most important survey task. The techniques evolved through use of such methods for friendly areas were to pay dividends when enemy-held areas were studied, yet the adequacy and detailed accuracy of the surveys suffered from lack of firsthand observation. Such a method further enhanced the need for use of personnel versed in the languages of the area under study, a need not to be satisfied until after the expansion in 1943. The earlier surveys had suffered in many instances from the author's lack of knowledge of foreign languages and consequent inability to utilize important documents. Yet, this lack of linguistic capacity may also have been of advantage at this stage, for the pressure that developed from the demand for an excessively large number of reports in an absurdly short period of time could never have been met had the investigators stopped for extensive study of foreign literature. Only by limiting themselves to the frequently scant material available in English could the production schedule be met. Thus, from the administrative standpoint, this linguistic limitation may have been a temporary advantage, but it meant that the early surveys were inevitably less comprehensive and detailed than those of a later period. The surveys appear, however, to have served the immediate needs; no one was probably more aware of the limitations of the reports than were those who worked on them.

¹³¹ See footnote 15, p. 258.

Throughout 1942 and the first half of 1943, Medical Intelligence Division had the benefit of the G-2 survey priority list in determining its work schedule. Although the form and scope of the surveys were dictated largely by the needs of the War Department Strategic Surveys, incorporation of the medical data in these surveys provided the greatest distribution and brought the information before those most concerned with operational planning. Throughout 1941, the strategic surveys had shown little concern for the medical problems that would confront a military force in a foreign area. A single paragraph headed "Public health, sanitation and hospitals," and incorporated in a sociologic chapter on "Population and Social Conditions," had been prepared by persons with neither medical nor sanitary competence nor appreciation. A paragraph on water supplies was hidden elsewhere in the text and often gave little attention to sanitary considerations. That diseases might differ from one country to another, that knowledge of potential insect vectors might be important, or that diseases might influence the course of military operations had been completely overlooked. The epidemiologic lessons of World War I, the Spanish-American War, the Civil War, or even of the Napoleonic wars had apparently not been learned by those responsible for intelligence planning. It was, therefore, important that preparation of this medical section of the War Department Strategic Surveys be transferred to competent hands.

This had been accomplished in part by a G-2 directive of 12 January 1942, establishing an outline for the strategic surveys and containing the following extract:¹³²

22. Public health, sanitation, and hospitals.

Organizations, extent, and effectiveness of public health agencies; public health laws and local ordinances; general sanitary conditions prevailing in the country, with details on special areas; most prevalent in diseases; existence of yellow fever; extent of venereal disease and public control; number, type, and location of all public and private hospitals, their bed capacity and laboratory facilities; buildings that in emergencies could be used as hospitals and barracks; number and distribution of doctors and dentists; number of trained nurses, their distribution and quality of training.

Note: The Bureau of Preventive Medicine, Surgeon General's Office, will furnish this paragraph on call or advance notice by calling Captain Wayne. This office is anxious to cooperate in preparing all medical data for Intelligence Branch surveys.

Although it would seem clear from this directive that medical intelligence was to be responsible for the still-meager medical section, the situation had remained confused for some time. The Office of the Coordinator of Information, which was responsible for the final editing of the strategic surveys, had continued to exercise its editorial prerogatives, to make changes, additions and subtractions, and otherwise alter the text. This had resulted in further discussions, culminating in a conference on 28 February 1942, at which it was agreed with G-2 and the Coordinator of Information that medical intelligence was to have responsibility for

¹³² See footnote 17, p. 260.

the medical section.¹³³ It had been further agreed that this should consist of a summary paragraph, including recommendations, to be written for the layman and incorporated in the text as heretofore, but that there would be a detailed medical appendix written for the surgeon of a task force, containing the details important for his orientation and planning.¹³⁴ In the implementation of this agreement, G-2 files were to be available to medical intelligence which, in turn, agreed to meet deadlines established by G-2, an agreement well observed in the coming years by both parties. The Coordinator of Information was to make data available to Medical Intelligence Division but was to discontinue medical surveys, an arrangement which was observed only in part, as shown by the subsequent appearance of surveys.¹³⁵

The developments of early 1942 had thus established medical intelligence in its rightful place within the War Department pattern but imposed upon it responsibility for more surveys than could be properly prepared by the small staff. Two surveys were completed in January, seven in February, eight in March, 10 in April, 13 in May, 16 in June, 11 in July, 14 in August, seven in September, 11 in October, three in November, and 10 in December.¹³⁶ These surveys covered portions of all continents and oceans. As the staff during this period varied from only two to five, the content of the surveys was still obviously extremely limited. The wonder is that they could have been completed at all. Medical intelligence was, in its haste and somewhat frantic scramble, attempting to compensate for the failure of the War Department to assemble this type of data during the years that preceded the outbreak of hostilities.

By the end of 1942, much of the lost ground had been partially regained. The Medical Intelligence Branch had prepared surveys on 119 areas and, incidental to its labors, had collected data on many others.¹³⁷ Some of this still unassembled material had been put to use. Its files had been studied by the medical staff assigned to the North African invasion though no formal surveys of Morocco, Algeria, or Tunisia had been prepared—possibly a deliberate omission as a matter of security. There remained, however, many areas of potential military importance that had not been surveyed, and the hastily completed surveys of many areas required revision to render them suitable for military operations that were so clearly in the offing. The tide of battle had now turned. The Germans had been thrown back at Stalingrad and El Alamein, and the forward advance of the Japanese stemmed at Coral Sea, Midway, Guadalcanal, and

¹³³ See footnote 20, p. 260.

¹³⁴ See footnote 17, p. 260.

¹³⁵ (1) Office of Strategic Services, Research and Analysis Branch, Report No. 1070, 6 Oct. 1943, subject: Health in Axis Europe. (2) Army Services Forces Manual M 354-13, Civil Affairs Handbook on Japan, Section 13, Public Health and Sanitation, 10 Feb. 1945. (3) Civil Affairs Handbook on France, Section 13, Public Health and Sanitation. Prepared by Office of Strategic Services for Military Government Division, Office of the Provost Marshal General. [Official record.]

¹³⁶ See semimonthly reports for each of these months.

¹³⁷ See footnote 19, p. 260.

Port Moresby. The survey task of 1943 was the completion of certain new reports and the revision of those dealing with areas in the obvious path of the Allied advance.

The surveys of 1943 were thus prepared on a somewhat slower schedule and with a larger staff of analysts. These surveys were based upon sources heretofore neglected because of limitations of time and language. Details formerly omitted could now be included. The outline on which the surveys were built was revised and expanded and valuable bibliographies incorporated. More detailed maps, usually prepared by the art department of the Army Medical Museum or reproduced from medical literature, were also included. The needs of the civil affairs program, as well as of the combat and garrison units, were recognized. Furthermore, a year of war experience, some of it bitter, had revealed certain types of conditions about which detailed information was most needed. During 1943, 62 surveys were produced.¹³⁸ As these were still prepared by the Ditto process, which limited the distribution to barely 100 copies, they failed to achieve their maximum potential usefulness.

The addition of a qualified public health engineer, Captain Pierce, to the medical intelligence staff in September 1943 marked a significant step in the improvement of the surveys.¹³⁹ Since the Hardenbergh-Sweet reports of 1940, development of the material on water supplies and sewage disposal facilities had failed to keep pace with the growth of other parts of the surveys, possibly because the reports had been prepared by medical personnel lacking in knowledge of water and sewerage problems. The result had been that the sections on water and sewage had become little more than the same type of vague generalities that had characterized the Coordinator of Information medical reports included in the War Department Strategic Surveys.

Early in the summer of 1943, the services of a qualified engineer, Capt. (later Maj.) Paul X. Blattler, SnC, for a few weeks of temporary duty had demonstrated the value of such a person in the survey program. With the arrival of an engineer on permanent assignment, a small engineering unit, consisting of this officer and a professional civilian assistant, was created within the Analysis Section. This unit took over responsibility for the water and sewage sections of the surveys. Close liaison was established with the Intelligence Branch of the Corps of Engineers, with the Engineering Research Office in New York, and with the Hydrographic Office of the Coast and Geodetic Survey in the Department of Commerce. During the 2 years of its existence, this unit assembled an incomparable bibliography on foreign water supplies and prepared a large number of excellent reports. As a result of its activities, the water and sewage sections, which had been weak parts of the surveys, developed into two of the most comprehensive and valuable sections.

¹³⁸ See footnote 30, p. 262.

¹³⁹ See footnote 45, p. 268.

The most significant event in 1943, with respect to the surveys, resulted from the decision of the Joint Chiefs of Staff to create the Joint Intelligence Studies Publishing Board which would prepare Joint Army and Navy Intelligence Studies, to be known as JANIS.¹⁴⁰ Effective on 1 July 1943, these studies replaced the War Department Strategic Surveys and the Office of Naval Intelligence Field Monographs and should have replaced some of the studies prepared by the Research and Analysis Branch of the Office of Strategic Services. The Joint Intelligence Studies Publishing Board, made up of War, Navy, and Office of Strategic Services representatives, prepared an outline for the JANIS which it submitted to the various contributing agencies. According to this preliminary outline, Medical Intelligence Division was to be responsible for preparing subsection 93 labeled "Health and Sanitation," to be incorporated as part of a section on "People and Government," thus perpetuating the subordinate position accorded health problems in the War Department Strategic Surveys. It is perhaps significant that, while the Board saw fit to prepare a detailed outline for all other sections, that for subsection 93 was not specified.

The general outline was, nevertheless, far from satisfactory.¹⁴¹ Subsection 93 dealt with the entire country under consideration but in section IX, dealing with individual cities and towns, there was to be a further section on health to be written by the Research and Analysis Branch staff of the Office of Strategic Services. The proposed outline of this latter section was accepted by the Office of Strategic Services, though it was more reminiscent of the thinking of 1850 than 1943; the location of cemeteries was made to seem of greater significance than the purity of the water supply. Subsection 65 on water supply of the country, also to be written by the Office of Strategic Services, properly considered geologic and physical aspects of water supplies and recognized the hydraulic and plumbing problems of distribution but completely overlooked the vital problems of treatment and purification.

In spite of repeated verbal protests from medical intelligence, the outline as proposed was put into effect. Well-meaning economists and litterateurs of the Office of Strategic Services visited Medical Intelligence Division to obtain material from which to write their discussions of health facilities of the cities (but had to search their own files as to cemetery locations). Geographers requested engineering data regarding water supplies and sewage disposal, rewriting for section IX what was included in subsection 93. Finally, the Joint Intelligence Studies Publishing Board decided that its staff of professional newsmen should rewrite subsection 93 "to conform with JANIS style." The inevitable result was as predicted, a garbling of fact for the sake of an allegedly "snappy" or vivacious literary style. At this stage, informal discussions gave way to written protest

¹⁴⁰ See footnote 47, p. 268.

¹⁴¹ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Director, Preventive Medicine Division, 31 July 1943, subject: Report of the Medical Intelligence Branch for the Period 16 July 1943 to 31 July 1943, Inclusive.

formally filed through the Commanding General, Army Service Forces.¹⁴²

Further conferences followed, as a result of which it was agreed that the medical material would be taken out of the sociologic chapter and become one of the 15 major chapters of each study, the outline and style to be revised somewhat in accordance with JANIS form.¹⁴³ The section on water supplies continued to be written under geographic guidance as section 92 of chapter IX, entitled "Resources and Trade," though it drew heavily on the water supply section prepared for the medical chapter by public health engineering staff of medical intelligence. The medical section was, however, accorded recognition as a major, not a minor, part of each survey, and a professional, not a lay group, prepared the material on medical matters. Thus was finally achieved what had supposedly been agreed upon at the conference with G-2 on 28 February 1942.¹⁴⁴ This agreement was slightly modified in July 1945 when certain details on water supplies were, over the oral protest of medical intelligence, shifted from the medical chapter to the section on water supplies still prepared under geographic rather than engineering guidance.

Operations of JANIS

The establishment of JANIS under the Joint Chiefs of Staff was both an advantage and a disadvantage to Medical Intelligence Division. On the credit side was the final acceptance of the principle that medical problems were to be recognized as a major component of an intelligence survey, were to be so presented to the planning staff, and were to be studied by a medical group. On the debit side was the added load upon the division and the fact that the JANIS schedule, originating from a higher echelon, took precedence over the schedule of surveys prepared specifically for medical use. Sufficient modification had to be made in these latter surveys to require complete rewriting. The schedule differed materially from that on which the division was otherwise operating and, as experience later showed, was somewhat less accurate. This meant an added load on medical intelligence and interrupted the orderly production of certain important surveys. Furthermore, the Joint Intelligence Studies Publishing Board too often kept its contributors uninformed as to developments, making changes of schedule with little advance notice. Reports due in 10 days might be suddenly demanded at the end of 5 days, while those due in 50 days might be advanced to 20 days with only a few days of warning. In spite of these difficulties, the Medical Intelligence Division met all of the deadlines. This was accomplished only by a tremendous amount of overtime work by the staff and at the price of the disruption of other activities. The

¹⁴² (1) Letter, Lt. Col. Robert J. Carpenter, MC, Executive Officer, to Commanding General, Army Service Forces, 4 Oct. 1943, subject: JANIS Outlines. (2) Memorandum, Col. J. M. Roamer, MC, for Maj. Gen. George V. Strong, 14 Oct. 1943, subject: Joint Army and Navy Intelligence Studies.

¹⁴³ See footnote 54, p. 269.

¹⁴⁴ See footnote 20, p. 260.

principle of the importance of medical intelligence was, however, established and far outweighed the setback in other parts of the program.

TB MED's publish the surveys

Meanwhile, the survey program of the division had had a great impetus through incorporation of the surveys in the TB MED series.¹⁴⁵ This series of publications, initiated on 1 January 1944, furnished a medium whereby surveys might be printed in large quantity and made available not only to a few headquarters but also to hospitals, battalion and division surgeons, and all other personnel or offices legitimately interested. New surveys, as they were prepared, were printed in this form, and many old ones were revised and printed. The vicissitudes of printing were many. Editorial style differed from that previously observed and from that demanded by JANIS. Copy was subjected to review and change by editors attached to the Adjutant General's Office and proof was read by the printer, or by the Adjutant General's Office, rather than by the office responsible for the manuscript. While this might have been satisfactory for nontechnical material, its results were both lamentable and humorous so far as concerned the highly technical material contained in medical intelligence surveys. Foreign terminology appeared in form hardly recognizable by a native of the country in question, new species of fauna and flora were created if one might judge from the scientific names that were published, and so private a creature as the "pubic louse" acquired notoriety as the "public louse." So serious became these mistakes that the Adjutant General's Office finally agreed to a special arrangement whereby the proofs of the surveys would be submitted to the Medical Intelligence Division to be returned within 48 hours.

The year 1944 saw a heavy survey program. Copy for 10 JANIS and for 54 TB MED's was submitted.¹⁴⁶ Of the latter, 23 represented new surveys, and 31, revisions of old surveys. The program continued unaltered until the defeat of Japan. By this date (14 August 1945), copy for seven JANIS and 19 TB MED's had been submitted during 1945.

In general, the surveys of the TB MED series appeared in ample time for planning and training purposes as well as for all operations that occurred after the inauguration of the series.¹⁴⁷ In some instances, however, the schedule was upset by circumstances beyond divisional control. The surveys of Japan and its dependencies should have been completed in 1944 at the latest. Eight months of enforced delay in obtaining an officer capable of

¹⁴⁵ Surveys of 18 areas, in various stages of completion on 31 Dec. 1943, were released in Ditto form early in 1944 before the details of the TB MED series were completed. Fourteen of these surveys later appeared in the TB MED series.

¹⁴⁶ See footnote 49, p. 269.

¹⁴⁷ Some of these surveys which appeared late were merely the printing of revised texts of surveys made before the inauguration of the series, as for example, TB MED 123, Medical and Sanitary Data on the Azores, Dec. 1944; TB MED 174, on India, July 1945; TB MED 178, on Italy, July 1945; and TB MED 189, on Ellice and Gilbert Islands and Nauru, 30 July 1945.

reading medical Japanese postponed the beginning of serious work on Japan until May 1944.¹⁴⁸ Demands for JANIS further upset the schedule, with the result that the text of the survey of Japan, TB MED 160, was not published until May 1945. Advance copies of sections of the manuscript had, however, been sent to the theater surgeon in February 1945 in an attempt to make the information available at the earliest possible date. Surveys of Korea, Manchuria, and Karafuto would have been completed in ample time for contemplated operations had it not been for the sudden cessation of hostilities in August 1945.¹⁴⁹ Under the circumstances, the only immediately available materials on these areas were the JANIS chapters which had been prepared earlier.¹⁵⁰

It should not be inferred, however, that JANIS reports were in all instances completed ahead of those for the TB MED series. On the contrary, the JANIS on Borneo was not available by the time of the invasion of that island, while TB MED 113 on Borneo had been released on 7 November 1944 and had been furnished to, and used by, the Australians in connection with the operation. Similarly, the JANIS on French Indo-China and the Banda Sea areas¹⁵¹ were in preparation at the termination of hostilities, whereas the several TB MED's on these areas¹⁵² had been completed and released between July and October 1944.

With the termination of hostilities, uncertainties arose as to the continuation of the surveys. The outbreak of war in 1941 had found the Medical Department without adequate information on foreign areas. It would have seemed obvious, therefore, that reason and expediency would dictate that the program be continued as an essential part of the task of maintaining a strong peacetime army. The apparent intention that the United States would participate in a postwar international military police force under the United Nations would further indicate the need for being prepared to send troops to any part of the globe on short notice. The plan submitted in October 1944 for a postwar medical intelligence had therefore envisioned a continuation of the survey program so that printed surveys would be available concerning all parts of the globe and that these should be revised regularly on an established schedule.

The end of the war found 73 surveys available in printed form, or in the hands of the printers. The original proposal for reduction in staff contemplated an orderly completion of all surveys then in preparation.

¹⁴⁸ See footnote 33 (2), p. 263.

¹⁴⁹ These surveys were later published as follows: TB MED 208 on Korea, Dec. 1945; TB MED 216, Medical and Sanitary Data on Manchuria, Feb. 1946; and TB MED 219, Medical and Sanitary Data on Karafuto, April 1946.

¹⁵⁰ These reports were Korea, JANIS 75; Manchuria, JANIS 74; and Sakhalin-Karafuto, JANIS 79. Copy for the chapters on Health and Sanitation was submitted on 27 Feb., 22 Aug., and 26 June 1945.

¹⁵¹ These reports were JANIS 70, Indo-China; JANIS 153, Java-Timor Area; and JANIS 156, Arafura and Banda Seas; copy for the chapters on Health and Sanitation was submitted on 22 August, 30 May, and 23 July 1945, but these were not published until after cessation of hostilities.

¹⁵² TB MED 86, Medical and Sanitary Data on French Indo-China, 18 Aug. 1944; TB MED 102, on Java, 10 Oct. 1944; TB MED 75, the Lesser Sunda and Southwestern Islands, 14 Oct. 1944; and TB MED 70, Molukken Islands and Islands in the Eastern Part of the Banda Sea, 21 July 1944.

Unfortunately, the excessive reduction in force compelled an abandonment of this program and the abrupt termination of several surveys. The lack of foresight in this reduction was soon obvious in the demand of the Joint Intelligence Studies Publishing Board for surveys of certain areas that were under study at the time the work had been ordered abandoned.¹⁵³ It was difficult to reinstate the discontinued activities.

An equally serious obstacle to the completion of the program appeared in the form of a refusal of the War Department Printing Board to accept more surveys for printing. A plan for orderly printing of surveys on a reduced schedule, as part of the postwar program, was submitted but not approved.¹⁵⁴ This policy was later relaxed so that a few of the surveys were published.

Surveys Prepared by Other Agencies

Although the survey program of the Medical Intelligence Division was more extensive than that of any other office, it was not the only one of this character. On the contrary, other offices, even within the War Department, were engaged in medical survey work but always on a markedly smaller scale. The Office of the Chief of Engineers, through its Caribbean Division, prepared the earliest surveys of the Caribbean Defense bases, surveys completed before the formal establishment of the Medical Intelligence Subdivision. In the course of the subsequent travels of the chief health officer of this office, Colonel Fox, visits were made to many areas incidental to the establishment of airroutes across Africa, and informal reports were prepared on the basis of these visits. These surveys based on firsthand inspections contained highly valuable local information and a more intensive report on certain limited areas than was achieved in any other survey. Based usually on a study of not more than 2 to 3 days, they obviously lacked the coverage that could be obtained through rather extensive library research. They thus constituted a most valuable supplement to the medical intelligence surveys and constituted little, if any, duplication of effort.

The Army Air Forces, through the ADTIC (Arctic, Desert, and Tropic Information Center), prepared brief surveys of about 20 areas, printing these as bulletins of 3 or 4 pages incorporated in the ADTIC Digest and Regional Medical Studies. In some instances, these represented little more than summaries of the material in medical intelligence surveys. In other instances, they represented independent research. Most of them were submitted to Medical Intelligence Division for comment before being printed. The quality was good, but in scope these reports lacked the details included in the medical intelligence surveys. There can be no doubt, how-

¹⁵³ See footnote 66, p. 272.

¹⁵⁴ Letter, Col. Robert J. Carpenter, MC, Executive Officer, Surgeon General's Office, U.S. Army, to War Department Printing Board, Washington, D.C., 4 Sept. 1945, subject: Curtailment of Printing, with 2d indorsement thereto, 4 Oct. 1945.

ever, that they provided valuable summaries in a small space, especially suitable for the use of laymen.

The Civil Affairs Training Unit of the Office of the Provost Marshal General likewise published sanitary surveys of a few countries as parts of their handbook series for Civil Affairs officers but assumed little responsibility for their preparation. These surveys were, in some instances, exact reproductions of medical intelligence surveys before inauguration of the TB MED series, or of surveys prepared by the staff of the Milbank Memorial Fund.¹⁵⁵ In other cases, the survey was prepared for The Provost Marshall General by personnel attached to the Research and Analysis Branch of the Office of Strategic Services who achieved their purpose through rewriting medical intelligence surveys. This rewrite produced such a garbling of fact, and was often so intermingled with fancy, that the well-meaning note of acknowledgment to medical intelligence was a source of more embarrassment than of appreciation.¹⁵⁶ One report of this series¹⁵⁷ was written jointly by staff members of the Office of the Provost Marshal General and the Office of Strategic Services and published and republished in spite of the fact that Medical Intelligence Division, on informal review of the original manuscript, had advised against publication because of the many errors and inaccuracies. The Provost Marshal General pointed out, however, that it could not wait for the TB MED to be published by Medical Intelligence Division which had been long delayed because of inability to obtain proper staff and necessity of meeting the demands of JANIS. Undoubtedly this was correct, yet hardly excuses the publication of inaccuracies which had been pointed out and were still carried into the reprinting.

Excellent studies were likewise prepared by the Navy and certain private foundations. Although there had been informal discussions with the Bureau of Medicine and Surgery, U.S. Navy, that indicated the likelihood that a medical intelligence unit would be established by the Navy,¹⁵⁸ no comparable program was ever initiated. Throughout the war, the Army surveys were furnished to the Navy and apparently were used by it. A small research program was established, however, within the Preventive Medicine Division of the Bureau of Medicine and Surgery and the Civil Affairs Division of the Navy Department. The former, employing two workers, confined itself to an intensive study of certain aspects of disease in limited areas in the Pacific, chiefly the Netherlands East Indies and the

¹⁵⁵ (1) Army Service Forces Manual M 359-13, Civil Affairs Handbook on French Indo-China, Section 13, Public Health and Sanitation, 16 Nov. 1943. (2) Civil Affairs Handbook on Greece, Section 13, Public Health and Sanitation, the Military Government Division, Office of the Provost Marshal General (preliminary draft). (3) See also comparable Civil Affairs Handbook on Yugoslavia.

¹⁵⁶ See footnote 135 (3), p. 304.

¹⁵⁷ Army Service Forces Manual M 354-12, Civil Affairs Handbook on Japan, Section 13, Public Health and Sanitation, 18 Dec. 1943.

¹⁵⁸ Memorandum, Lt. Col. Tom F. Whayne, MC, for Chief, Preventive Medicine Service, Surgeon General's Office, 31 Aug. 1942, subject: Report of the Medical Intelligence Division for the Period From 16 August 1942 to 31 August 1942, Inclusive.

China coast.¹⁵⁹ Although these excellent studies contained much of the same material incorporated in medical intelligence surveys, the project cannot be considered a duplication of effort. In reality, both offices worked in close and harmonious collaboration, each profiting from the work of the other. The Navy Civil Affairs manuals were also confined to a limited number of areas in the Pacific. Although in some instances they were based largely on previously issued medical intelligence surveys, they were sufficiently elaborated to be of very substantial added value;¹⁶⁰ in other cases, they represented entirely independent research.¹⁶¹ The collaboration of medical intelligence with the Military Government Section, Office of the Chief of Naval Operations, was less close than with the Bureau of Medicine and Surgery, but there was a substantial degree of mutual assistance.

Valuable surveys of certain areas were also prepared by the research staff of the Milbank Memorial Fund, of the Near East Foundation, and of the Health Research Unit of the Health Section of the League of Nations.¹⁶² The information made available by these agencies was considerable but did not achieve a wide dissemination except as it was used as a basis for reports by Medical Intelligence Division and the Civil Affairs Handbook of the Office of the Provost Marshal General.¹⁶³

Of a different quality were the surveys prepared by the nonmedical staff of the Office of Strategic Services and of the Board of Economic Warfare (later the Foreign Economic Administration).¹⁶⁴ The latter office discontinued its survey program early in 1943, but the Office of Strategic Services persisted much longer. Not only were area studies prepared but also studies of special medical or sanitary topics.¹⁶⁵ This program was the apparent outgrowth of the early activity of the Office of the Coordinator of Information in connection with the War Department Strategic Surveys. When Medical Intelligence Division took over the medical section of the surveys, one might have expected that the Office of Strategic Services, lacking competent personnel for this type of work, would have gladly shifted its social scientists to activities within their proper sphere of training. Yet, studies were continued and, with the creation of JANIS, an attempt was made to obtain a semiprofessional staff.

¹⁵⁹ (1) *Epidemiology of Diseases of Military Importance in the Netherlands Indies*. NAVMED 183, 20 Aug. 1943. (2) *Epidemiology of Diseases of Naval Importance in China*. NAVMED 630, undated.

¹⁶⁰ *Civil Affairs Handbook on Taiwan (Formosa)*, Section on Population Figures and Public Health, OPNAV 50E-12, Office of the Chief of Naval Operations, U.S. Navy Department, 15 June 1944.

¹⁶¹ *Civil Affairs Handbook*, Section on Health and Sanitation, Mandated Marianas Islands, OPNAV 50E-8, 1944, West Caroline Islands, OPNAV 50E-7, 1 Apr. 1944, and East Caroline Islands, OPNAV 50E-5, Office of the Chief of Naval Operations, U.S. Navy Department, 21 Feb. 1944.

¹⁶² (1) *Report on Public Health in Yugoslavia and Medical Report on Tunisia*, prepared by the staff of the Milbank Memorial Fund, undated. (2) Carr, Alice G.: *Public Health, Medicine, and Sanitation in Greece*. Prepared by the Near East Foundation, December 1942. (3) *Public Health in French Indo-China*. Prepared by the Health Research Unit of the League of Nations, Health Section, Washington, D.C., December 1944.

¹⁶³ See footnote 155 (2), p. 311.

¹⁶⁴ *Suggested Health Precautions for Government Representatives in North and West Africa*, Board of Economic Warfare, Blockade and Supply Branch, Reoccupation Divisions. R.R.-23-Rev. 2, March 1943.

¹⁶⁵ See footnote 135 (1), p. 304.

Unfortunately, however, medical matters were left as the responsibility of well-meaning, but untrained personnel, and water supply problems were detailed to geographers lacking even the most elementary of knowledge of sanitary engineering. Following a series of conferences in December 1943, incidental to JANIS,¹⁶⁶ it was supposedly agreed that the Office of Strategic Services, which had now acquired the part-time services of a highly competent medical economist (Dr. Nathan Sinai), would confine itself to the preparation of data on medical economics and allied matters not covered by the medical intelligence surveys. This plan, apparently agreed to by the Office of Strategic Services, Medical Intelligence Branch, and the Civil Affairs Division of the War Department General Staff, was observed only in part. Throughout the next year, health reports from the Office of Strategic Services were slowly discontinued, but nonengineering attempts to write on sanitary engineering topics continued.

As one reviews this activity on the part of the Foreign Economic Administration and of the Office of Strategic Services, one cannot escape a somewhat depressing sense of wonder and amazement that professionally educated persons should have the temerity to wander so far from their fields of training and competence. There can be no doubt that both agencies had a remarkably able collection of highly trained research workers, often drawn from the teaching staff of the better universities. The competence of these persons within their respective fields of economics, history, political science, anthropology, geography, or other social science cannot be doubted, nor can one doubt that they would have been horrified at the presumption of a mere physician who attempted to prepare a technical treatise on international finance, the history of political parties in Germany, or the anthropologic characteristics of the tribes of West Africa.

Yet these same individuals did not hesitate to write within the field of medicine, public health, and sanitary engineering, and even resisted attempts to transfer this activity to trained personnel. One may wonder at the inconsistency of the educated mind and regret that the highly personal character of health and medicine, which requires each person to assume some responsibility for his own welfare, should be so magnified as to lead the public to believe that competence within the field of public health is to be gained other than by intensive study and learning. The incident may be also a reflection of the journalistic glamour that has surrounded certain popular lay writers within the field of medical science, a glamour which has tempted other less qualified persons to make independent and unchaperoned excursions into this treacherous field.

Somewhat similar and equally depressing reflections are inspired by review of the medical sections of the economic surveys of northwest Africa issued in 1943 by the U.S. Tariff Commission. Yet one finds it difficult even to imagine how the most uninformed layman could find references in

¹⁶⁶ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Director, Preventive Medicine Division, 16 Dec. 1943, subject: Report of the Medical Intelligence Branch for the Period 1 Dec. 1943 to 15 Dec. 1943.

the published literature to support the statement that "in the morning the leaves of the plants are covered with dew and malarial germs, which, it is said, in a few hours are absorbed into the products themselves," that "typhoid fever * * * is spread by mosquitoes and fleas," that "malarial fever * * * as well as being spread by mosquitoes and fleas * * * is caused by digging in the loamy soil * * * and from drinking water or milk from these regions," and that "shutters, especially on windows in sleeping quarters * * * are said to help exclude the night germ-laden aid."¹⁶⁷ Fortunately, surveys of this character found little circulation and apparently did little harm, possibly because the average layman could easily recognize the obvious errors. That such statements should have been produced at all is, however, a sad commentary on the willingness of certain persons to write with an apparent voice of authority within the popular field of health.

Special Medical Intelligence Reports

In addition to the formal surveys, the Medical Intelligence Subdivision prepared a large number of special reports for the Joint Chiefs of Staff, G-2, or other parts of the Surgeon General's Office. The Planning and Training Division had made repeated requests to Preventive Medicine Division for such information late in 1940 and early in 1941, requests which had served to emphasize the need for a special medical intelligence unit. During the latter half of 1941 and 1942, numerous further requests were received but very few were made after 1942. On the contrary, the number of requests for special reports for G-2 and the Joint Topographical Subcommittee of the Joint Chiefs of Staff increased, especially during 1944.

These special reports, prepared incidental to the planning of a specific military operation, usually dealt with a limited geographic area, and varied from a few pages of generalities to fairly comprehensive studies containing precise details. Because of the nature of the projects and the need for the highest possible degree of secrecy, the preparation of these reports required special security measures. Knowledge of their preparation was usually limited to one, or at most two, members of the staff. The need for security and the limited time allowed for their completion (usually 1 day to 1 week) precluded library research. In their preparation, previous surveys and the voluminous files of the division were invaluable; without such files, their preparation would have been impossible.

Maps of Disease Distribution

Maps of geographic distribution of certain diseases were first developed in the fall of 1941¹⁶⁸ in response to a need for a simple graphic

¹⁶⁷ Spanish Morocco and the Tangier Zone. Washington: U.S. Tariff Commission, April 1943, pp. 82-85.

¹⁶⁸ Memorandum, Capt. Tom F. Whayne, MC, for the Chief, Preventive Medicine Division, Surgeon General's Office, 8 Oct. 1941, subject: Report of the Subdivision of Medical Intelligence for the Month of September 1941.

method of showing what diseases might be encountered in various areas. The data then available were such that certain minor inaccuracies crept into these maps. Early in 1943, a revision was made but unfortunately without technical cartographic advice or assistance. The data incorporated in this revision were improved but were still inadequate for the precision that is desirable in map production. Additions and corrections were subsequently made, but no opportunity was afforded for the thorough revision that was desirable and for which the services of a competent medical geographer were requested but denied.

Pamphlets on Health Precautions

Instructions as to health precautions for personnel going to certain areas were developed in response to requests from the Air Corps when worldwide air routes were being established.¹⁶⁹ These pamphlets, first prepared late in 1941, were not designed for operational planning but rather for the personal guidance of those who might otherwise find themselves isolated from sources of information and in need of some general instructions. They were prepared at a time when the medical intelligence functions were considered to include tropical disease control.

No one had envisioned the TB MED series whereby medical intelligence surveys might be made available on a worldwide basis. Consequently, the health precautions were prepared as a semitechnical bulletin, not as a popular health pamphlet. The result was too technical for effective popular use, yet not sufficiently detailed to meet the technical demands. The instructions filled a definite need of that period, and were widely distributed, first in mimeographed form, later as printed pamphlets, signed by the Chief of Staff "By order of the Secretary of War." They thus acquired official status almost a year before such recognition was accorded the surveys. Four such pamphlets were developed dealing with health precautions for Africa; South America and Caribbean Area; African and Asiatic countries along the Mediterranean Sea, Red Sea, and Persian Gulf; and the Far East.¹⁷⁰

Late in 1944, some thought was given to a possible revision of certain of these pamphlets, but the idea was dropped and they were allowed to go out of print, for the TB MED series was furnishing the technical information, and a completely new type of popular booklet was needed to reach the needs of the average soldier. Such a project was beyond the scope of medical intelligence, so was not pursued further.

¹⁶⁹ Memorandum, Capt. Tom F. Whayne, MC, for the Chief, Preventive Medicine Division, Surgeon General's Office, 7 Nov. 1941, subject: Report of the Subdivision of Medical Intelligence for the Month of October 1941.

¹⁷⁰ (1) War Department Pamphlet No. 8-1, 2 Apr. 1943. (2) War Department Pamphlet No. 8-2, 2 Apr. 1943. (3) War Department Pamphlet No. 8-3, 20 Apr. 1943. (4) War Department Pamphlet No. 8-4, 21 Apr. 1943.

Analysis of Captured Equipment

The collection and study of enemy equipment is a well-recognized intelligence activity, for through such measures much can be learned about enemy resources. The measures that were developed for the collection of samples of enemy equipment have already been discussed previously as a part of the collection program. The subject cannot be dismissed without a few more words about the processing of this equipment and the dissemination of knowledge gained thereby.

At no time during the war was there keen interest in enemy equipment on the part of the Medical Department. The materiel possessed no tactical importance unless examination of it revealed signs of impending resort to chemical or bacteriologic warfare; responsibility for detection of such intentions had been placed upon the Chemical Warfare Service, not upon the Medical Department.¹⁷¹ Nor was medical equipment of great importance in training, for Medical Department personnel were taught to use American, not captured, equipment. Emergency use could be made of captured medical materiel without elaborate instruction; bandages and surgical equipment are enough alike so that they may be used properly by the capturing force without special instruction. The use of captured drugs was never encouraged. The chief value of knowledge of enemy equipment lay, therefore, in its examination for new ideas worthy of incorporation in U.S. equipment and in its use for care of the civil population of liberated or captured territory. The former required careful testing and examination if it were to be really meaningful; cursory examination was of little value.

Throughout the war, there was little evidence of real medical interest in this type of activity because of a belief that the progress of medical science in the Axis countries was definitely behind that of the United Nations. This belief was based on knowledge of the extent to which political ideology had been permitted to supplant brains in the fields of science in Germany, Italy, and Japan. The prewar medical research of these countries had so deteriorated that little could be expected under the pressure of war. While this lack of interest was therefore probably justified in most matters, it did lead to overgeneralization and to loss of sight of the few items in which enemy technology had a definite advantage over that of the United States or Great Britain. Thus, little interest was shown in Washington in the German developments in field X-ray apparatus; later experience showed that medical units capturing such equipment were finding it to possess definite advantages. Similarly, certain surgical instruments and other hospital supplies were found to possess advantages that appealed to the field army. It thus became apparent that, while Axis science was definitely behind American science, its technology had often made definite

¹⁷¹ Memorandum, Henry L. Stimson, Secretary of War, for Chief of Staff, 13 Jan. 1944, subject: Biological Warfare, with 2d indorsement thereto, from Lt. Gen. Brehon Somervell, Commanding General, Army Service Forces, to Chief, Chemical Warfare Service, 15 Jan. 1944.

strides. Even those, however, were in the nature of improvements and refinements rather than the development of basic new principles.

In view of this general and possibly justified attitude of indifference on the part of the Medical Department, little attention would have been paid to captured materiel had it not been for the insistence of ASF Intelligence Division. This office, impressed by the excellent program developed by the Ordnance Department for tactical reasons, attempted to force all the technical services to develop an equally energetic and comprehensive program.¹⁷² In doing so, it lost sight of the fact that the needs and problems of the services were so different that generalization could not be made. Although this was repeatedly discussed with Army Service Forces and with apparent agreement as to the differences in the problem, ASF directives continued to appear that perpetuated the attempt at generalization.

Under these directives, the Surgeon General's Office was required to make a full study of all captured materiel and to make reports thereon to ASF Intelligence Division. A formal distribution list for such reports was even prescribed by Army Service Forces. The nature and content of the reports were specified in detail. Examination of these outlines showed clearly that they were built in terms of development of counterweapons, revealing enemy shortages which might be aggravated by proper bombing. In other words, they were strictly within the field of weapons and were not suitable for reports on medical equipment.

Inasmuch as Medical Intelligence Division had already been made responsible for captured equipment reaching the Surgeon General's Office,¹⁷³ the responsibility for compliance with these directives devolved upon this division. Some of the responsibility could, however, be shared with the Field Equipment Laboratory housed at Carlisle Barracks but operating under direction of the Technical Division. This laboratory was the logical unit for the examination of field equipment. Examination of other items such as biologicals, drugs, and other chemicals could be carried on more effectively from Washington.

Preparation of the required reports necessitated proper cataloging, detailed description of the items, translation of labels and instructions, laboratory testing as to content and efficacy, and comparison with U.S. equipment. The Field Equipment Laboratory was equipped to handle all items shipped to it, submitting its reports to Medical Intelligence Division for distribution in accordance with ASF directives. The Medical Intelligence Division, on the other hand, was not prepared to handle all phases of the samples for which it assumed responsibility. Materiel for analysis and comparison was shipped to the laboratories of the Army Medical School,

¹⁷² Report of Army Intelligence Officers' Conference, New Orleans, La., 17-19 Nov. 1943.

¹⁷³ Letter, Col. J. M. Roamer, MC, Director of Intelligence, Army Service Forces, to The Surgeon General, 16 Aug. 1943, subject: Intelligence Activities of the Office of The Surgeon General, with 1st indorsement, Col. John A. Rogers, Executive Officer, Office of The Surgeon General, to Director of Intelligence, Army Service Forces, 19 Aug. 1943.

to the Army Medical Purchasing Office, to the Bureau of Entomology and Plant Quarantine of the U.S. Department of Agriculture, and to the National Research Council. Many samples were examined by these several agencies and their findings incorporated in reports prepared in the Medical Intelligence Division.

During the early part of the war, this work could be handled as a part-time activity of the staff working on other problems. By the spring of 1944, however, the amount of materiel had become so large, and the need for close liaison with the Field Equipment Laboratory so great, that the full time of an officer, Capt. Ray F. Chesley, SnC, who had spent almost 3 years in the China-Burma-India theater, was devoted to this work. During the 8 months that Captain Chesley was assigned to this work, he processed an enormous amount of materiel, preparing reports on all items of significance. Even more important, he developed not only an effective liaison with the Field Equipment Laboratory, but also aroused sufficient interest to effect a takeover of this function by the laboratory staff. Consequently, the position in Medical Intelligence Division was abolished, and responsibility for processing of all equipment was assumed by the Field Equipment Laboratory,¹⁷⁴ paving the way for a more active interest in the large amount of German equipment received in the spring and summer of 1945 from the enemy equipment collection teams in the European and the Mediterranean theaters.

By July 1945, the medical equipment collection program in the European theater had reached the point where the officer in charge could return to the Zone of Interior and devote his attention to the reception of the equipment. Major Plishner continued on the ASFEEIST allotment but served at Carlisle Barracks until November 1945. During this period, he directed the sorting, assembly, and cataloging of the German equipment so that it might be available for later study by the laboratory staff.¹⁷⁵

The enemy equipment program again focused attention upon the anomalous position occupied by medical intelligence as a part of one of the component services of the Surgeon General's Office, not as a staff division. The program was certainly not one of preventive medicine. The collection of the materiel and its review for possible light it might cast on enemy resources and manufacturing sites was an intelligence function, but the study of it for comparison with U.S. equipment and the discovery of new features worthy of copy belonged to the Technical Division. This was the division of labor ultimately agreed upon as the most logical and satisfactory.

¹⁷⁴ Memorandum, Lt. Col. Gaylord W. Anderson, MC, Director, Medical Intelligence Division, for the Chief, Preventive Medicine Service, Office of The Surgeon General, 6 June 1945, subject: Annual Report for the Fiscal Year 1944-45.

¹⁷⁵ (1) Letter, Maj. Meyer J. Plishner, SnC, ASFEEIST (Medical), to Chief, Medical Intelligence Division, Office of The Surgeon General, 29 May 1945, subject: Enemy Equipment Intelligence Service Activities.

(2) See footnote 101, p. 288.

A second important aspect of the captured medical equipment program was the possible use of this materiel for treatment of the civil population of enemy areas. Considerations which lead to a hesitancy to use enemy drugs and apparatus in the treatment of U.S. soldiers could not preclude their use in the care of a civil population.¹⁷⁶ But before this materiel could be so used, knowledge of its identity and characteristics was essential.

Some slight consideration was given to this problem in Washington, but the flow of equipment was so slow until the end of hostilities that no effective program could be developed. Work of this character was logically a theater function. In Europe, there was relatively little need for such work as an intelligence function. Civil affairs officers were adequately versed in German to be able to deal with such equipment. In the Orient, however, a real need existed for intelligence work to make possible the orientation of civil affairs personnel. To this end, the medical section of the 5250th Technical Intelligence Composite Company prepared an excellent illustrated handbook whereby Japanese drugs could be readily identified. This handbook was used extensively in field operations and in the training of civil affairs personnel.¹⁷⁷

DISSEMINATION OF INTELLIGENCE

Collection and study of data serve no useful intelligence function unless the information so obtained can be made available to those in need of it or in a position to put it to practical use. Medical intelligence, like all other intelligence programs, fails in its purpose unless provided with a satisfactory means of dissemination. In many respects, this represented the most difficult of all administrative problems of the program and one which, in spite of the attention given to it, was the least satisfactorily solved.

Ideally, all items of information should be made immediately available to all units to which they would be important but without jeopardy to the security precautions surrounding an intelligence program. The complex administrative organization of a military force scattered in all corners of the globe and the autonomy of the various theaters presented obstacles to dissemination of any item of information beyond a certain command level. Finally, the subordinate position in which the Surgeon General's Office was placed by the Army reorganization in War Department Circular No. 59, dated 2 March 1942, constituted an administrative handicap to the dissemination of information even to medical units.

¹⁷⁶ Letter, Maj. Eugene H. Manley, CE, Assistant Coordinator, Technical Intelligence, Office of the Assistant Chief of Staff, G-2, to Military Intelligence Division, War Department, 18 Aug. 1944, subject: Booklet, Japanese Equipment, Medical, with 1st indorsement, The Surgeon General, to Military Intelligence Division, War Department, 10 Oct. 1944.

¹⁷⁷ See footnote 107 (2), p. 291.

Publication and Distribution of Surveys

The original studies and surveys made during the period preceding the formal establishment of medical intelligence were prepared for use within the Surgeon General's Office. A few typewritten copies therefore sufficed. The more detailed reports on the defense bases prepared by the Surgeon General's Office and by the Caribbean Division of the Office of the Chief of Engineers were mimeographed. The exact distribution of each of these surveys is not recorded, but at least some of the surveys of the engineers were distributed to the major components of the Army during the spring of 1941 by The Adjutant General "By direction of the Secretary of War" with the notation that certain recommendations contained therein were to be put into effect.¹⁷⁸ The same official status was, unfortunately, not accorded the reports prepared under the auspices of The Surgeon General until their incorporation in the TB MED series in 1944.

During the first few months of operations of the Medical Intelligence Subdivision, typewritten copies of all reports had sufficed; by November 1941, the requests for copies had increased to the point where utilization of some duplication process was indicated. From that date, until the establishment of the TB MED series in 1944, all surveys were reproduced by the Ditto process, and copies were mailed informally to selected headquarters on a purely informational basis. This mailing list was in large part the outgrowth of contacts established with various recipient agencies through means of visits, lectures, and correspondence.

While G-2 continued to be the primary recipient of the surveys, routine distribution to War Department training installations, elements of the Air Forces, the Bureau of Medicine and Surgery, and the Office of the Coordinator of Inter-American Affairs had been established by the middle of 1942. Copies of surveys were also furnished to surgeons of forces going to foreign areas, provided these individuals chanced to visit Medical Intelligence Division. Many Army installations and governmental agencies concerned with foreign areas, such as the Bureau of Economic Warfare and the Office of Strategic Services, had requested to be added to the mailing list.

The reasons that governed the decision to rely on such informal channels rather than to seek some sort of official recognition are not clear. Throughout this period, multigraphed "Surgeon General's Letters" were utilized to transmit information as to policies and practices to various parts of the Medical Department. These letters had an official status within technical, though not command, channels. The incorporation of the surveys within these letters, as they were later included in the TB MED series along with material formerly distributed through the letters, could have brought the information to all medical units.

¹⁷⁸ See footnote 8, p. 255.

Many reasons probably governed the decision not to attempt to use this channel of dissemination. The information contained in the surveys was classified, and too widespread dissemination at this period might have had undesirable consequences so far as concerned military security, in that knowledge of the areas selected for study and report might have been interpreted as a revelation of future operations. By the time the TB MED series was established, the pattern of future military operation was so clearly drawn that publication of surveys of various areas could hardly reveal more than had been publicly announced.

It is not likely, however, that problems of security were the decisive factor in not attempting to use The Surgeon General's circular letters as a medium for dissemination as certain surveys were later published in abstract form in the *Army Medical Bulletin*.¹⁷⁹ A more likely explanation is to be found in the fact that the concept of the surveys was too novel to entitle them to incorporation in these letters even had such been formally requested. Medical intelligence was a new concept not yet established in official thinking. Although the Operations Service of the Surgeon General's Office made a few requests for specific data in connection with its planning, there is no evidence that until the middle of 1943 it had any real interest in, or appreciation of, the value of the surveys. As late as May 1943, it was not in sympathy with even an informal distribution of the dittoed copies. It is therefore apparent that the potential value of such data for training purposes and for operational planning in the field was so little appreciated, even within the Surgeon General's Office, that widespread dissemination through official or semiofficial channels would not have been favorably considered. Under the circumstances, the decision to provide for a limited and informal distribution was inevitable. Medical intelligence had to acquire more age and stature before it could be afforded recognition.

In the meantime, copies of each survey were turned over to the Military Intelligence Service, G-2. While this was the logical channel for intelligence dissemination and should have brought the information to staff attention, there is no evidence that the 1941 surveys did more than find their way to the files. The same fate was accorded many of the 1942 and 1943 surveys. War Department Strategic Surveys of the Latin-American countries were already in preparation, or had been published, by the time the Medical Intelligence Subdivision was established. The meager

¹⁷⁹ (1) Medical and Sanitary Data on Australia. Army M. Bull. 63: 1-40, July 1942. (2) Medical and Sanitary Data on New Zealand. Army M. Bull. 63: 41-70, July 1942. (3) Howard, W. A.: Medical and Sanitary Data on Anglo-Egyptian Sudan. Army M. Bull. 64: 23-61, October 1942. (4) Horack, H. M.: Medical and Sanitary Data on British Solomon Islands Protectorate. Army M. Bull. 65: 1-17, January 1943. (5) Horack, H. M.: Medical and Sanitary Data on the Territory of Papua, the Australian Mandated Territory of New Guinea (Including the Bismarck Archipelago). Army M. Bull. 65: 18-49, January 1943. (6) Wayne, T. F.: Medical and Sanitary Data for Levant States. Army M. Bull. 65: 50-72, January 1943. (7) Slater, P. R.: Medical and Sanitary Data on Yugoslavia. I. Public Health and Environmental Factors Influencing Health and Sanitation. Army M. Bull. 66: 137-160, April 1943. (8) Rutherford, R. B.: Medical and Sanitary Data on Greece. I. Public Health and Environmental Factors Influencing Health and Sanitation. Army M. Bull. 66: 161-180, April 1943. (9) Slater, P. R.: Medical and Sanitary Data on India. Public Health and Environmental Factors Influencing Health and Sanitation. Army M. Bull. 68: 16-106, July 1943.

paragraph on health and sanitation in these surveys had been written by nonmedical personnel in the Office of the Coordinator of Information. Not until 1942 was the material prepared by Medical Intelligence Branch used in these surveys and thus disseminated through the normal intelligence channels.¹⁸⁰

The incorporation of suitable medical intelligence reports in the War Department Strategic Surveys was not, however, an adequate answer to the dissemination problem. The Strategic Surveys were extremely limited in number of copies and, like all other intelligence documents, were so carefully guarded as to be accessible to few persons. It is characteristic of military forces that the medical staff is too often excluded from participation in the operational planning. Hence the surveys, even when widely distributed through normal intelligence channels, were often not accessible to medical personnel. Incorporation of a suitably prepared medical section in these surveys, and even the later inclusion of an entire medical chapter as one of the major parts of JANIS, could rarely reach beyond the non-medical operational staff and would never assure that the information would filter down to the lower levels of medical command where it would be put to actual use. Other methods of dissemination were therefore essential.

The possibility of providing for more extensive utilization of the medical intelligence data was, however, not overlooked. On 20 May 1942, The Surgeon General who, by the recent reorganization of the Army as published in War Department Circular No. 59 had become subordinate to the Commanding General of the newly created Services of Supply, recommended to the latter that a directive be issued pointing out the availability of medical information in foreign countries and "requiring Surgeons of missions and medical officers of medical missions to report to the Office of The Surgeon General to study those data," and also indicating that suitable data could be furnished for missions not organized in Washington. This request was ignored; no acknowledgment or reply was ever made.

The distribution of the surveys was thus limited to the Zone of Interior, even though the war was being fought overseas and medical installations in the theaters might benefit from the information available in Washington. When overseas headquarters had been established, information about the areas within their jurisdictions had usually not been available in Washington; even if available in the files, it had often not yet been assembled into a report that could be taken overseas with the headquarters staff. Furthermore, medical intelligence was too new to be known so that few requests for information would have been made even if the information had been available in printed pamphlet. Visitors to the Surgeon General's Office were often introduced to Medical Intelligence Branch, but these visitors included only a small fraction of those who were to be in

¹⁸⁰ See footnote 17, p. 260.

positions of responsibility overseas. War Department Strategic Surveys of some of the areas most important in late 1942 and early 1943 were not available until the middle of 1943. Thus, medical personnel overseas were not furnished suitable information about the health problems of their respective areas.

As this information was being rapidly assembled in the form of medical intelligence surveys, one might have expected that these surveys, even though late, would be forwarded to the theater as rapidly as completed. Medical surveys of the Solomons and of Eastern New Guinea were available in early 1942;¹⁸¹ U.S. troops did not begin operations in these areas until the latter half of 1942 or early 1943. Yet, aside from the occasional copy of a survey that might have been picked up in Washington by a unit commander who happened to know or suspect he was en route to the Southwest Pacific, these surveys did not reach the theater, a fact to be remembered in the light of subsequent disease experience in these areas.

The simplest expedient would have been to mail copies to the chief surgeon of each theater as rapidly as reports became available. Adequate copies were available and were reposing on the shelves of the medical intelligence office. Yet as late as May 1943, the chief of the Operations Service, and director of its component Planning Division stated that, in view of the autonomy of the theater, The Surgeon General could not forward this information to the theater surgeon and that the responsibility of the Surgeon General's Office had ceased when a copy of each report had been made available to G-2. It was further stated that the surveys would be of little value to the theaters, that there was already an unnecessarily wide distribution, and that all the copies actually needed could be prepared by a single typing. Inasmuch as the Operations Service was responsible for all official dealings with the theaters, this decision was final. Whether or not an issue should have been made of this obstruction to dissemination is debatable.

Change of direction of the Operations Service in 1943, after appointment of Maj. Gen. Norman T. Kirk, as The Surgeon General, and Col. (later Brig. Gen.) Raymond W. Bliss, MC, as chief of the Operations Service,¹⁸² brought about an immediate reversal of policy. Not only were several copies of each survey dispatched to the chief surgeon of the appropriate theaters, but copies were also sent to surgeons of all adjoining theaters or any other theater that might have potential interest in any particular area. Surveys at last began to become available where they were most needed and, if one may judge from informal comments, where they were often most appreciated.

¹⁸¹ (1) Medical and Sanitary Data on British Solomon Islands Protectorate. Compiled by the Medical Intelligence Branch, Preventive Medicine Division, Surgeon General's Office, U.S. Army, 21 April 1942. (2) Medical and Sanitary Data on the Territory of Papua, the Australian Mandated Territory of New Guinea (Including the Bismarck Archipelago). Prepared by the Medical Intelligence Branch, Preventive Medicine Division, Surgeon General's Office, U.S. Army, 14 May 1942.

¹⁸² Office Order No. 428, Surgeon General's Office, U.S. Army, 30 June 1943.

Hoarding of surveys was thus replaced by a policy of such widespread dissemination that the inadequacy of the Ditto process, which yielded not over 125 copies, soon became apparent. This inadequacy was further emphasized by the request of the Chief of Transportation in March 1943 for copies of surveys for use in ports of embarkation, where they would be open to examination by surgeons of units preparing to depart overseas.¹⁸³ Requests for additional copies of surveys for distribution through such ports could not be honored immediately because of lack of an adequate number of copies. Similarly, a request of the Armored Force Surgeon for copies for distribution to Armored Force units for training purposes could be honored only by provision of an extra copy for loan purposes.¹⁸⁴

In the meantime, somewhat wider dissemination of the contents of a few surveys had been achieved through publication in abridged form in the *Army Medical Bulletin*.¹⁸⁵ As this bulletin theoretically reached all Medical Corps officers, it served to publicize the existence of certain surveys; yet the reader might have inferred that comparable data did not exist on areas other than those published. Reprints of these condensations were available for distribution but the demand was never great as the surveys printed usually dealt with areas, the immediate military importance of which had largely passed. The use of the *Bulletin* as a medium of dissemination had a further serious obstacle in that a quarterly bulletin,¹⁸⁶ which could carry one or at most two surveys per issue, could never print enough of the surveys to cover the needs of a global war.

As wider dissemination was essential but hinged on facilities for reproduction in greater quantity, conversations relative to other methods of duplication were begun with the Reproduction Branch of the Adjutant General's Office as early as May 1943.¹⁸⁷ No solution to the problem was immediately forthcoming, but it is possible that the discussion may have had some slight influence upon the subsequent decision of the Adjutant General's Office to establish the TB MED series.

The first intimation of the forthcoming TB MED series was at a conference to discuss plans for the revision of the *Army Medical Bulletin*, in the course of which conference representatives of the Adjutant General's Office indicated that the TB MED series to be established 1 January 1944 was to replace a wide variety of special bulletins and routine letters issued by the technical services and suggested that both The Surgeon General's circular letters and the medical intelligence surveys be printed in this form for wider distribution. It was explained that surveys so printed would be

¹⁸³ Memorandum, Chief of Transportation, for The Surgeon General, 12 Mar. 1943, subject: Medical Surveys.

¹⁸⁴ Memorandum, Lt. Col. Gaylord W. Anderson, MC, for Director, Preventive Medicine Division, 15 May 1943, subject: Report of the Medical Intelligence Branch for the Period From 1 May 1943 to 15 May 1943, Inclusive.

¹⁸⁵ See footnote 179, p. 321.

¹⁸⁶ The *Army Medical Bulletin* continued as a quarterly publication until October 1943 when it began to appear as a monthly periodical under the title of the *Bulletin of the U.S. Army Medical Department*.

¹⁸⁷ See footnote 184, above.

automatically distributed both within the Zone of Interior and the theaters on the same basis as other War Department bulletins. It is of interest to note that the first definite suggestion that the surveys be widely distributed and be accorded the status of an official War Department publication thus came from the Adjutant General's Office rather than from the controlling authority within the Surgeon General's Office. Thus, at a single stroke and by action initiated from outside the Surgeon General's Office, the surveys were to reach the theaters in quantity and were to be accorded an official status not received since the engineer surveys of defense bases early in 1941.

The official status of the surveys meant more than mere recognition. As they contained recommendations as to procedures to be followed to safeguard the health of troops in the area covered by the report and were signed by the Chief of Staff "By order of the Secretary of War," a channel was established whereby The Surgeon General might officially convey specific recommendations to all theaters backed by the authority of the War Department. This constituted an important, but perhaps not fully appreciated, restoration of certain prestige lost when the Surgeon General's Office was submerged as a subordinate unit under the Services of Supply (later the Army Service Forces) by War Department reorganization of 1942.

Incorporation of the surveys in the TB MED series brought with it new problems incidental to style and paragraphing to conform with rigid regulations of the U.S. Government Printing Office and the Adjutant General's Office. It was also attended by long delays incidental to stylistic editing, setting of type, and reading of proofs. In some instances, printing contracts were made with private presses that showed little inclination to expedite the few reports that were in obvious need of rush handling. Delays were many and annoying, but, by 1 July 1944, surveys of 18 areas had been printed; by 1 January 1945, 50; and by 1 July 1945, 62. In all instances, several additional surveys were in the hands of the printers awaiting publication. The surveys so printed included not only those just finished but also a large number completed during 1943 which were published in the TB MED series for the sake of widespread dissemination.

Problems of printing, however, introduced certain inevitable delays in obtaining the finished product for distribution. In some instances, as long as 3 months elapsed between submission of copy and the release of the printed survey.¹⁸⁸ Information available in Washington, and possibly of immediate value to the theater, might thus be subject to long delay before its arrival overseas. To obviate part of this difficulty, the manuscript submitted to the Adjutant General's Office for printing was also prepared by the Ditto process and copies dispatched by airmail to appropriate theater

¹⁸⁸ Letter, The Surgeon General, to the Commanding General, Army Service Forces (attention: Director of Intelligence), 30 Aug. 1944, subject: Report on Medical Intelligence Activities for Week Ending 26 August 1944.

surgeons at the same time the manuscript was submitted for printing. Through this expedient, delay in making the data available to theater headquarters was reduced. The theater surgeon, not only in possession of the data, but also informed of publications that were in press, was in a position to requisition an adequate supply for distribution within the theater.

The incorporation of the surveys in the TB MED series transferred distribution responsibilities from Medical Intelligence Division, to the Adjutant General's Office. A suggested routine distribution list was worked out with the Plans Division of the Surgeon General's Office, with the Office of the Air Surgeon, and the Ground Surgeon's Office. Thus, routine distribution was made in the Zone of Interior, and adequate supplies were shipped to each theater for widespread use. The Chief of Transportation directed that copies of surveys be distributed to all medical units passing through the ports of embarkation,¹⁸⁹ though it is doubtful if this latter order was carried out meticulously even after the surveys were available. The widespread distribution envisioned by these schedules necessitated a printing of from 4,000 to 8,500 copies of each survey. Several of the surveys were reprinted, in one case at least four times. Thus, the use of the TB MED series as a means of dissemination finally made the surveys available in quantity adequate for all possible needs.

It does not follow, however, that the circulation envisioned by the distribution schedule appended to each survey was actually achieved in the theaters. As all shipping was theater controlled, the quantity of surveys actually shipped was limited by the theater and not the Adjutant General's Office. Policy as to theater use and distribution differed. No distribution was made within the Mediterranean theater, possibly because the chief need for the surveys had passed before they became available in printed form in the spring of 1944 and possibly because the preventive medicine officer of the Office of the Surgeon had sincere doubts as to their value. In the European theater, early distribution was blocked by a theater publications screening board which, without consulting the Chief Surgeon, excluded the shipping of all such medical publications, including the entire TB MED series.¹⁹⁰ Even after this difficulty had been corrected and copies of surveys became available in headquarters, they were unobtainable by subordinate commands, reputedly on the basis that all medical directives were rewritten and issued over the signature of the Chief Surgeon, ETOUSA. Whether or not this was the correct reason is not clear, but the fact remains that surveys were not widely available.

In the Southwest Pacific Area, surveys were somewhat more available, though not uniformly so, leading to the complaint of the X Corps that "a complete absence of medical and technical professional data relative to the

¹⁸⁹ Memorandum, Chief of Transportation for Commanding Generals of Boston PE (Port of Embarkation); Charleston PE; Hampton Roads PE; New York PE; San Francisco PE; Seattle PE; and Commanding Officer of New Orleans PE and Los Angeles PE, 15 Jan. 1944, subject: Dissemination of Medical Information.

¹⁹⁰ See footnote 174, p. 318.

islands of Leyte and Samar hindered preplanning of health preventive measures."¹⁹¹ As the survey of the Philippine Islands was available in printed form in advance of the operation,¹⁹² and advance copy of the text had been furnished both the surgeon of SWPA headquarters as well as theater SOS headquarters almost 2 months in advance of publication, it is apparent that the information was not always shared with the units under theater direction. In other instances, however, copies of surveys were distributed or were extracted in theater publications. Presumably, the data were also used in preparation of the theater intelligence studies. The Central Pacific theater (later the Pacific Ocean Areas), on the other hand, made a deliberate effort to achieve a systematic distribution of the surveys. In the China-Burma-India theater, the surveys seem to have been widely disseminated, though there were unfortunate delays in certain instances. Distribution appears to have been more satisfactory among the Air Corps units in all theaters, possibly in part because the Air Corps arranged for its own transportation; in part, because the Air Surgeon possessed a more direct supervisory relation with respect to the medical services of theater air units than existed between The Surgeon General and medical personnel in the theaters; and, in part, because of active interest in the surveys.

It is obvious from the foregoing that dissemination of surveys was at no time satisfactory. In the early phases, the chief obstacle lay within the Surgeon General's Office, but when this was removed and a satisfactory plan evolved to permit widespread circulation, dissemination broke down at the theater level. While it is easy to criticize these defects and to attempt to fix responsibility, the basic difficulty appears to have been far more fundamental than the apparent shortsightedness of any individual or group of persons.

The basic difficulty lay in the general unpreparedness that characterized the entire Nation before the war emergency. Medical intelligence surveys should have been begun not in 1940 or 1941, but in 1935 or earlier, when the rumblings of the coming war were becoming so audible in both Europe and Asia. Had the intelligence program been begun at this early date, knowledge of the functions of this activity would have been more widely disseminated within the Medical Department. Vital information would have been available as needed, and there would have been no need for resort to hasty last-minute dissemination after theater headquarters had been well established, after most of the units had arrived on the scene, and after much of the operational planning was well advanced. Prompter distribution and wider use of the somewhat belated information would have partly offset the early lack of data, but no system of dissemination improvised as an emergency measure could compensate for the loss of several precious years before the outbreak of hostilities. The lesson of the price of unpreparedness in this limited segment of the entire war program seems so

¹⁹¹ See footnote 52, p. 269.

¹⁹² Released by the Adjutant General's Office on 20 Aug. 1944.

obvious, when viewed in retrospect, that the apparent willingness of certain persons to effect an immediate postwar scrapping of the program seems hardly understandable.

With the end of hostilities, a plan for orderly printing of surveys on a reduced schedule as part of the postwar program was submitted but not approved.¹⁹³ Only those surveys already in type were completed. Fortunately, this absolute refusal to accept further surveys was later softened, so that eight in preparation at the end of the war were later published.¹⁹⁴ The shortsightedness that halted the distribution program seems a strange contrast to the initiative and foresightedness of the same office in suggesting incorporation of the surveys in a series of official bulletins.

Publication of "Global Epidemiology"

Closely allied with the problem of distribution of the surveys was that of attempting to make the information contained in them as generally available as possible, consistent with security. Public distribution was out of the question as the surveys were all classified. Late in 1942, the late Mr. Archie Woods, then president of the John and Mary R. Markle Foundation, was so impressed with the wealth of information contained within the surveys that he proposed a project whereby the material might be made available to the general public. Under the guidance of the Committee on Information of the Division of Medical Sciences of the National Research Council and with financial assistance and guarantee of the Markle Foundation, a project was evolved whereby certain surveys, especially those of tropical areas, would be revised and edited for public sale. To this end, the National Research Council executed a printing contract with the J. B. Lippincott Company. Assistance in the form of the loan of personnel services was received from the Mayo Clinic and the American Medical Association.

As the project evolved, the need for modification became apparent. Data on a few tropical countries would satisfy no one and would fill no need. To be of value, the project required separation into logical geographic areas and publication of all surveys dealing with each area. The plan of publication was accordingly revised, and a first volume of *Global Epidemiology* was prepared covering India, the Far East, and the Pacific Area.¹⁹⁵ This made available, in a single volume, a vast amount of information never before assembled and generally unavailable to the reading public. The limitations to such a work were best expressed in the introduction to the volume as follows:

No one can be as aware of the limitations of such a volume as are those who have labored over it. Much of the material has been gathered under the impelling whiplash

¹⁹³ See footnote 154, p. 310.

¹⁹⁴ (1) Letter, Maj. Gen. Norman T. Kirk, The Surgeon General, to The Adjutant General, 20 Dec. 1945, subject: Medical and Sanitary Surveys. (2) Letter, Col. L. C. Boineau, the Adjutant General's Office, to The Surgeon General, 4 Jan. 1946, subject: Technical Bulletins, MED Series.

¹⁹⁵ Simmons, James S., Whayne, Tom F., Anderson, Gaylord W., and Horack, Harold M.: *Global Epidemiology: A Geography of Disease and Sanitation*. Philadelphia: J. B. Lippincott Co., 1944, vol. 1.

of speed. Military operations do not wait for painstaking scholarly research. Information often had to be obtained on short notice and surveys rushed to have information available by certain dates. Some of the reports so completed have been redone, but time has not permitted as careful reanalysis as might be desired in all cases. Sources of information have undoubtedly been overlooked. In a work of this character, errors and omissions are inevitable, especially in the initial stages.

The authors do not present this work as a final or finished task. From the standpoint of scientific accuracy they would have preferred to have delayed it for scrutiny under more leisurely conditions of peace. They have been persuaded, however, to release the material at this time and in this form because it was apparent that so much of the material here assembled was of immediate value to so many interests yet was not readily available elsewhere.

Errors did exist and were kindly pointed out by friendly critics so that they might be corrected in part in a second printing which appeared within a few months after the first. Like so many works of this character, the book represented a useful compilation, and, in spite of its obvious limitations, appears to have served a useful purpose. It was a source of real regret on the part of the authors that the pressure to bring out the book in 1944 necessitated use of certain early surveys that were so much less accurate and complete than were those later available and published in the TB MED series.¹⁹⁶

The modified plan of the book called for at least three more volumes, one dealing with Europe, one with Latin America, and a third with Africa and the Near East. Ultimately, a fifth volume dealing with most of North America, Russia, and other extreme northern and southern areas would be required to achieve realization of the title "Global Epidemiology." Beginnings were made on subsequent volumes, but military demands precluded the assignment of the necessary personnel to this task. The end of the war and the advent of demobilization found the European volume about one-fourth finished and a small start made on the volume on Africa and the Near East.¹⁹⁷

Maps of Disease Distribution and Prevalence

Dissemination of other types of information prepared in the Medical Intelligence Division underwent stages of development comparable to those experienced by the surveys. The maps of the geographic distribution of various diseases prepared late in 1941, and later revised early in 1943, were originally duplicated by the Multilith process and distributed directly by Medical Intelligence Division. Through the Committee on Information of the Division of Medical Sciences of the National Research Council, and with the financial assistance of the John and Mary R. Markle Foundation, copies were distributed in quantity to all medical schools, and enlargements

¹⁹⁶ For example, compare chapter 7 on Japan in "Global Epidemiology" with TB MED 160, Medical and Sanitary Data on Japan, May 1945.

¹⁹⁷ This project has been continued in the postwar period under a research grant to the School of Public Health of the University of Minnesota for the U.S. Public Health Service. Volume II on Africa appeared in 1951. Volume III on the Near and Middle East was published in 1954.

prepared for lecture purposes. Later, in response to a suggestion from the Commanding General, Army Service Forces, maps were issued on 25 October 1943 as War Department Pamphlet No. 8-6 and thus were made available from the Adjutant General's Office for widespread distribution to all troops.¹⁹⁸

Pamphlets on Health Precautions

Distribution of the pamphlets on health precautions to be observed in various foreign areas went through a comparable evolution. These precautions, written for Air Forces units that were establishing international air routes, were at first mimeographed and distributed by Medical Intelligence Division. By early 1943, the demand had become so great that these also were printed as War Department pamphlets and made available for training purposes through the Army.¹⁹⁹ By arrangement with the Office of the Chief of Transportation,²⁰⁰ copies were distributed to troops passing through ports of embarkation, such pamphlets being released on the transports after departure from port.

Documents

Distribution of information about health hazards of foreign areas was not, however, the only dissemination problem. Through various channels, chiefly G-2, Medical Intelligence Division received each week several hundred documents, many of which contained valuable information on a wide variety of medical topics, including medical research of Allied Governments, medical experience of U.S. and Allied armies under combat conditions, medical problems of enemy forces, and conditions affecting health and medical care in countries throughout the world. Such documents served no useful purpose unless brought to the attention of those components of the Medical Department for which they were of maximum value. In view of the position of the Surgeon General's Office with respect to other parts of the Army, this meant only the installations under immediate control of The Surgeon General, for the Office of the Air Surgeon and the Ground Surgeon were served directly by Air Forces and Army Ground Forces liaison officers with G-2. Systematic abstracting of these documents, as well as of the foreign literature, had been considered at one period as a potential

¹⁹⁸ (1) Army Service Forces, Conference of Commanding Generals, Service Commands, Chicago, Ill., 22-24 July 1943. (2) Memorandum, Assistant Chief of Staff, Army Service Forces, for The Surgeon General, 27 July 1943, subject: Action Directed at Conference of Service Commanders. (3) Memorandum, The Surgeon General, for Chief of Staff, Army Service Forces, 6 Sept. 1943, subject: Action Directed at Conference of Service Commanders. (4) War Department Circular No. 254, 21 June 1944.

¹⁹⁹ (1) See footnote 170, p. 315. (2) War Department Circular No. 232, 25 Sept. 1943 (rescinded by War Department Circular No. 254, 21 June 1944).

²⁰⁰ (1) Letter, The Adjutant General to the Commanding Generals, Army Air Forces, Army Ground Forces, Services of Supply, all Armies, Service Commands, Ports of Embarkation; the Commanding Officers, Ports of Embarkation; the Chiefs of Supply and Administrative Services, Services of Supply, 9 Nov. 1942, subject: Health Precautions.

responsibility of Medical Intelligence Division, but had been abandoned at the time of the expansion because of the expressed preference for a system whereby the original documents would be available for scrutiny within the offices most concerned with the contents.

To accomplish this distribution consistent with security required the installation of a system to screen, catalog, and lend documents to appropriate offices. This necessitated establishment of a new cataloging system in June 1943 whereby all documents might be classified geographically and by subject. The system introduced was a modification of one developed by the American Society of Geographers.²⁰¹ Circulation was determined by the medical intelligence staff which, after scrutiny of a document, attempted to assure its loan to each office that might have a potential interest. Administrative problems incidental to such a loan system were legion. If the division, like the intelligence units of other technical services, had adopted the policy of merely collecting data and relying upon other offices to come to it to discover what was in the files, certain of these problems might have been avoided, but such a plan would certainly have fallen far short of the desired goal of making all possible information available to all parts of the Surgeon General's Office. It is to be hoped that the value of the information disseminated was adequate to offset the grief that resulted from such a system.

Distribution of documents was not limited, however, to the confines of the Surgeon General's Office. Many were loaned to the Army Medical School, to the Medical Field Service School, and to the Armored Medical Research Laboratory at Fort Knox, Ky. In many instances, extra copies were forwarded for retention. Viewed in retrospect, it would appear that more items might profitably have been loaned to these installations. By special arrangement with G-2, extra copies of many technical intelligence reports originating within Army circles were forwarded to the National Research Council where they might be made available to scientists engaged in studies of interest to the Medical Department.²⁰² As many of these research projects had been initiated at the request of the Surgeon General's Office, the investigators were entitled to share in all technical information of value to their studies. Through this channel, many valuable documents were made available to research workers throughout the country.

Medical Intelligence Abstracts

Even if perfect distribution of documents among installations under control of The Surgeon General could have been achieved, this would not have provided adequate dissemination of information. The documents con-

²⁰¹ Boggs, S. W.: *Library Classification and Cataloging of Geographic Material*. Ann. Assoc. Amer. Geographers 27: 49-93, June 1937.

²⁰² (1) Letter, Dr. Lewis H. Weed, Chairman, Division of Medical Sciences, National Research Council, to Lt. Col. Gaylord W. Anderson, MC, 21 Oct. 1943. (2) See footnote 61, p. 270. (3) Letter, Lt. Col. Gaylord W. Anderson, MC, to Chairman, Division of Medical Sciences, National Research Council, 16 Nov. 1943.

tained information of value for training, of value to theaters, and to many other components of the Army. Even though the Army organizational chart assigned a very limited responsibility to the Surgeon General's Office, there remained a moral duty to keep all components of the Medical Department as fully informed as possible, irrespective of the command to which they were attached. The *Army Medical Bulletin* offered a suitable channel for dissemination of unclassified information, but not for that which must be kept from unauthorized eyes.

The first attempt to solve this problem was initiated in July 1943 when typewritten copies of abstracts of some of the most significant documents were circulated to a few divisions within the Surgeon General's Office. This was not an attempt to revive the unwanted technical abstracts but rather the expression of a realization that many offices might have a definite, yet limited interest, in documents other than those which came to them as a matter of primary concern. Abstracts of a wide selection of the most significant documents would keep these offices informed as to items beyond the scope of their immediate responsibilities.

The response to a few "issues" of these abstracts was such that formal request was made to The Adjutant General for permission to issue periodically a mimeographed circular of "Medical Intelligence Abstracts."²⁰³ As these were to contain items classified as high as "secret," limited distribution to a selected group of headquarters was proposed. Authority to issue and distribute as many as 300 copies twice a month was granted, and Medical Intelligence Abstracts made its appearance as an official publication of the Surgeon General's Office. The distribution never exceeded 123 copies, was limited to certain major headquarters in the Zone of Interior, to theater surgeons, and to a list of headquarters selected by the Ground Surgeon and the Air Surgeon. The reception accorded the bulletin was good.

Throughout the remainder of 1943, the abstracts appeared as a separate bulletin. In 1944, with the establishment of the TB MED series, the Adjutant General's Office, in an attempt to eliminate independent publications of the technical services, ordered incorporation of the abstracts in the TB MED series. This was protested in vain by Medical Intelligence Division on the grounds that the issue of a bulletin of such limited circulation as part of a series, the other number of which had widespread distribution, would create serious confusion and lead to endless correspondence with offices failing to receive certain issues to complete their office files. The protest was of no avail but, after four sets of abstracts had been issued under this plan,²⁰⁴ the Adjutant General's Office, possibly in response to the many queries made as predicted, suddenly discovered a technicality by

²⁰³ Letter, The Surgeon General, to The Adjutant General, 18 Oct. 1943, subject: Medical Intelligence Abstracts.

²⁰⁴ These abstracts issued were TB MED 13, Medical Intelligence Abstracts No. 4, 22 Feb. 1944; TB MED 17, Medical Intelligence Abstracts No. 5, 6 Mar. 1944; TB MED 34, Medical Intelligence Abstracts No. 6, 20 Apr. 1944; and TB MED 51, Medical Intelligence Abstracts No. 7, 15 June 1944.

which it concluded that Medical Intelligence Abstracts was a trespasser within the TB MED series and peremptorily ordered its removal.²⁰⁵ Allied with this was a condition that distribution of intelligence bulletins of all technical services must thereafter be limited to those offices "approved" by the Director of Intelligence of Army Service Forces.²⁰⁶ Thus Medical Intelligence Abstracts reverted to its status as a mimeographed independent bulletin, the distribution of which was to be subject to control of a higher echelon. In reality, this imposed no obstacle, for every recommendation as to change in the distribution list was routinely approved by Army Service Forces.

Medical Intelligence Abstracts continued to be issued at irregular intervals until V-J Day (14 August), when it was discontinued by War Department Memorandum No. 310-45, issued on 17 Aug. 1945. After about November 1944, it deteriorated in quality and, by the time of its demise, was virtually defunct. More imagination and journalistic sense were needed in its preparation. The basic idea of the project was doubtless sound for a mass of worthwhile material was available, if it had been properly utilized. The fundamental weakness was lack of a suitable officer with journalistic sense coupled with medical knowledge and theater experience. An attempt to obtain such an officer who had had over 3 years of overseas duty, and was therefore eligible for return, was blocked by the Adjutant General's Office early in 1945 through its refusal to request his return.

Briefing for Overseas Duty

Closely allied with the problem of collection was that of orientation of personnel departing for overseas assignments, especially in the intelligence field. It has already been pointed out that certain types of intelligence, particularly that involving highly tangible items, can be collected effectively by personnel not technically trained, provided they have been oriented as to the type of information desired. Such personnel, on the other hand, are usually eager to obtain full information regarding health hazards to be encountered and personal measures to be taken for protection. Thus, dissemination of information paves the way for collection of intelligence.

Instruction was given to numerous groups of persons destined for overseas assignment. A medical intelligence officer participated in the monthly orientation course for military intelligence personnel, and many of the G-2 staff were received in the Medical Intelligence Division for special briefing. Lectures were given in training courses under the auspices of the Office of Strategic Services, the Foreign Economic Administration, the Department of State, and the Civil Affairs Training Schools at the University of Chicago, University of Michigan, University of Pittsburgh,

²⁰⁵ Letter, the Adjutant General's Office to Chiefs of Technical Services, 14 Apr. 1944, subject: Regularly Recurring Intelligence Publications Originating in the Technical Services, Army Service Forces.

²⁰⁶ Memorandum, Maj. O. J. Magee, Quartermaster Corps, Office, Director of Intelligence, Army Service Forces, for Chiefs, Intelligence Branch, Technical Services, 25 Apr. 1944.

University of Virginia, and Yale University. Many lectures were also given at the Army Medical School. During the early part of the war, students at the Army Medical School visited Medical Intelligence Subdivision, but this was discontinued as the classes at the school expanded and the course became overcrowded with other material. Although these many orientation lectures often appeared to be time consuming, especially when given away from Washington, they were probably a highly effective means of disseminating information, orienting personnel as to the scope of medical intelligence, and stimulating more comprehensive collection.

Finally, reference should be made to the endless stream of requests from varied sources, both military and civilian. Many of these requests were in writing, others by telephone, and still others through personal visit. They ranged from requests for surveys of various countries to precise data as to disease occurrence in a specific locality, or information on medical practices, facilities, or experiences of enemy or Allied armies. Although often highly time consuming, and at times prompted by little more than idle curiosity, they did represent a growing interest in, and possibly an appreciation of, medical intelligence. Certainly the inconvenience occasioned by the occasional trivial question was more than offset by the interest evidenced by those that were worthwhile. In the answering of these questions, the files of the Medical Intelligence Division were invaluable.

MISCELLANEOUS PROBLEMS AND ACTIVITIES

In addition to the activities described previously, numerous minor duties were imposed upon Medical Intelligence Division by the ASF Intelligence Division, most of which had little real relationship to an intelligence program.

Exchange of Technical Information with Foreign Nationals

War Department Memorandum No. W380-44, published on 25 February 1944, provided definite procedures for exchange of technical information with representatives of foreign nations. The director of the Medical Intelligence Division was empowered to act for The Surgeon General in all matters pertaining to such exchange.²⁰⁷ Although one would like to believe that the procedures set forth in these War Department directives were drawn up to maintain proper security with respect to scientific and technologic advances, careful study of the directives and participation in some of the conferences held during their preparation showed that too often the guiding principle was protection of U.S. patent rights—a worthy objective but hardly applicable to the field of medicine.

Army Service Forces directives²⁰⁸ as to compliances restricted the re-

²⁰⁷ See footnote 60, p. 270.

²⁰⁸ (1) Army Service Forces Circular No. 59, 26 Feb. 1944. (2) Letter, Deputy Director of Intelligence to The Surgeon General, 18 Apr. 1944, subject: Accredited List of Foreign Representatives.

lease to a small handful of foreign nationals permanently assigned to Washington and duly "accredited to receive technical information." Unfortunately, the circular and directives applied to release of all technical information, not simply that which was classified, nor was distinction made between details of a new type of machine gear or war gas and an improved method of immobilization of fractures. The directives even covered information already published in medical journals where friend and foe alike might read, yet, if the regulations were interpreted literally, this same technical information could not be given orally to a distinguished, but transient, foreign visitor, nor would he be allowed to visit the public reading rooms of the Army Medical Library or attend the clinical staff meeting of an Army hospital.

The ASF Intelligence Division called countless meetings of the intelligence units of the technical services and wrote an endless string of supplemental directives in an effort to bring responsibility for enforcement of these provisions within their field of activity. At these meetings, the absurdity of the situation, and the impossibility of compliance without openly insulting distinguished foreign visitors, was repeatedly pointed out by representatives of Medical Intelligence Division; these protests were repeated in written form. The only modification was a slight change whereby visitors properly introduced and accompanied by accredited representatives might be given suitable technical information. At no time were the regulations put in such a form that they could be properly observed by Medical Department installations.

The ASF Intelligence Division desired that the exchange of technical information in each of the technical services be centered in the appropriate intelligence unit. Within the Office of The Surgeon General, nothing was to be gained by such centralization; the Medical Intelligence Division never requested it. The division was, however, delegated responsibility for clearance of visitors, a function exercised but little owing to persistent failure of other parts of the office to request such clearance either before, or at the time of, visits. Although these regulations and directives were probably marked more by their violation than by their observance, there was no evidence of unauthorized release of classified information to foreign nationals.

Security

Although in some of the technical services the intelligence unit was made responsible for counterintelligence and for security, these functions in the Surgeon General's Office were not detailed to the Medical Intelligence Division, even though ASF Intelligence Division, shortly after its birth, made an attempt to secure such a consolidation of functions. Even within the Preventive Medicine Service, the security function was assigned to the executive officer of the service. All counterintelligence functions were

assigned to an intelligence officer directly responsible to The Surgeon General. Although the difference between this office and the Medical Intelligence Division was often confusing to many persons (including mail clerks and ASF intelligence), the separation of functions produced a satisfactory working arrangement. If medical intelligence had been directly responsible to The Surgeon General as recommended by the Committee to Study the Medical Department,²⁰⁹ the two offices might well have been fused. The problem of declassification was similarly not detailed to Medical Intelligence Division, though the division had constantly to assist ASF Intelligence Division on medical matters pertaining to classification.

Information to Army Service Forces Intelligence

Throughout the war, ASF intelligence showed an extreme eagerness to assume added tasks provided added staff was allocated for the new duty, though the actual load was invariably shifted onto the technical services. Unfortunately, the latter did not acquire added staff as such duties were loaded onto them. Equally unfortunate was the fact that many of the tasks had little, if any, relations to intelligence, and even represented duplication of activities of other ASF components. For example, the creation of a bulletin on operational experiences and a bulletin on field improvisations were scarcely intelligence functions.²¹⁰

Equally far removed from intelligence were the requests²¹¹ for periodic reports on all new equipment developed, and on changes in training doctrine resulting from interviews with returned troops, reports which would have duplicated reports already being made to other ASF divisions. The number of requests for periodic submission of information of this character was legion. Had all been complied with, the staff of the Medical Intelligence Division would have required expansion of at least 50 percent, and countless hours would have been spent each month by other components of the Surgeon General's Office in assembling basic material. The demands were so heavy as to raise seriously the question as to whether the Medical Intelligence Division was operating for the benefit of, and under the direction of, the Medical Department, or as a unit subservient to the ASF Intelligence Division.²¹² The issue was never brought to a head, even though

²⁰⁹ See footnote 39, p. 265.

²¹⁰ (1) Memorandum, Director of Intelligence, Army Service Forces, for The Surgeon General, 17 Nov. 1943, subject: Combat Lesson Bulletin. (2) Letter, Director of Intelligence, Army Service Forces, to Chiefs of Technical Services and Directors of Staff Divisions, 24 Jan. 1944, subject: Reports for Operations Division, War Department General Staff. (3) Letter, Director of Intelligence, Army Service Forces, to The Surgeon General, 22 Mar. 1944, subject: Operations Division, War Department General Staff, Publication "OPDIB" and "Combat Lessons."

²¹¹ Letter, Director of Intelligence, Army Service Forces, to The Surgeon General, 7 May, subject: Weekly Report of Intelligence Activities.

²¹² History of the Intelligence Division, Army Service Forces. Prepared by Intelligence Division, Army Service Forces, 1945. Manuscript (incomplete), 177 pp. text, and three large volumes of "appendixes" (directives, reports, publications, etc.) classified; confidential and secret. On file in the Office of the Chief of Military History, Department of the Army, Washington, D.C.

NOTE.—During the final review of the manuscript "Medical Intelligence," the just-cited documents were

medical intelligence certainly failed to file all the countless reports that were endlessly requested. In its failures to meet the demands of Army Service Forces, medical intelligence had the company of all the other technical intelligence units.

CONCLUSIONS AND EVALUATION

The ultimate purpose of any historical account is to assist succeeding generations to avoid the errors of their predecessors. Without evaluation, history is but a barren narrative of past events. Obviously, however, such an evaluation will be colored by the opinions, prejudices, and biases of the evaluator, especially if he has had any part in the happenings that are being chronicled. Too often, he has lived so closely to these events that he fails to see them in their proper relationship to the larger kaleidoscopic scene of which they were but a small and insignificant part. His opinions must, therefore, be taken with due allowance for bias, and yet they cannot be completely ignored, for he is often aware of circumstances that might have escaped the recognition of others. The following evaluation of some of the accomplishments, shortcomings, and difficulties of medical intelligence is therefore made with full recognition of possible bias but with the thought that it may be of aid to those who must deal with this problem in the years to come.

At the outset, one may ask if medical intelligence was valuable and worthwhile. There are those who have sincerely questioned its value. Undoubtedly, successful military operations were carried on without this information but often at needlessly high expense of preventable illness. The high incidence of malaria in the early operations in the Pacific is striking evidence of the fact that the possible implications of disease had not been adequately considered in the planning phases. On the other hand, it cannot be denied that medical intelligence, like all other parts of the intelligence program, was not thinking in terms of the Pacific during the months preceding the strike on Pearl Harbor. Information on the hazards of the Pacific islands was, therefore, not available when troops were first dispatched and the early operation planned. The fact remains, however, that,

called to the attention of the Historical Unit, United States Army Medical Service, by the Office of the Chief of Military History. They were examined in detail by the Chairman of the Advisory Editorial Board on the History of Preventive Medicine in the United States Army in World War II. It is clear from these documents that the mission of the Intelligence Division, Army Service Forces, as established on 1 June 1943, and extended thereafter from time to time, was not only to plan and coordinate the foreign technical, and domestic intelligence and counterintelligence activities of the Army Service Forces, but it was also in charge, on behalf of the War Department, of all Counterintelligence Corps activities and military and civilian censorship in overseas areas under Army control. Its responsibilities and workload were enormous. The broad scope and power of the Intelligence Division, under basic directives from the Commanding General, Army Service Forces, included staff supervision over all intelligence activities of the Army Service Forces. Although, as pointed out by Dr. Anderson in this chapter, there was abundant and onerous concern of Intelligence Division, Army Service Forces, with the Medical Intelligence Division, Surgeon General's Office, there is little mention either of the Surgeon General's Office or of medical intelligence in the document cited in this reference.—S. B.—J.

had the information been available, its value appreciated, and its warnings applied, there would have been far fewer casualties from disease.

Even later in the war, however, the warnings of medical intelligence appear to have been ignored in the planning and briefing operations. During the operations on Saipan, dengue exacted a heavy toll of illness and all but immobilized certain units. The medical intelligence survey, prepared and available well in advance of the operation, had listed dengue as the main disease hazard. Similarly, there had been warnings of scrub typhus on the western end of New Guinea and of schistosomiasis on Leyte.

The reasons why such warnings were overlooked may be hard to determine. To the writer, there would appear to have been two basic reasons neither of which involves any element of negligence. Medical intelligence was new to the Army and its potential value, therefore, neither known nor appreciated. Such information had never heretofore been available nor had a need for it been felt. All officers in positions of major responsibility had been trained on the lessons of World War I when the U.S. Army had had no need for such data, as it was joining a campaign that was already almost 3 years old and was being fought in an area with a sanitary culture and disease problems comparable to those of the United States. The whole training and tradition of the Army has been that of initiative and ability to adapt itself to widely varied field conditions. Such a philosophy had been instilled in the basic training of line and medical officers. Medical intelligence was so new that few officers were even aware of its existence. Without a feeling of need for its assistance, they would hardly have sought the information that was available from this source.

A second reason for neglect of its warnings lay in defects of dissemination. The best of intelligence is of no value unless it reaches those in a position to use it. Unquestionably, dissemination was the chief bottleneck in the medical intelligence program of World War II. In the early days, barely a hundred copies of medical intelligence reports were available. Incorporation of medical intelligence information in the War Department Strategic Surveys, and later in the Joint Army and Navy Intelligence Studies, was only a partial solution as the distribution of these documents was also extremely limited. Publication in the TB MED series provided an ideal dissemination medium, but unfortunately this medium was developed late in the war when a large part of those in need of information were already overseas where bulk shipping was at a premium and redistribution of published material was attended with serious difficulties. Had a better method of dissemination been available in the early years, the value of the medical intelligence program would certainly have been enhanced.

The operation of the collection and analysis programs also had shortcomings. The most serious of these was that the programs were constantly striving to make up for lost time. The phrase "too little and too late" was peculiarly applicable to medical intelligence, especially in its early phases. Begun barely 2 years before the outbreak of hostilities and seriously

understaffed, it could never overcome the handicap of a late start. The demands for information by certain dates were so urgent that many of the reports were of necessity sketchy, and errors of fact were inevitable. Numerical inadequacy and linguistic limitations of staff in the early days made thorough studies impossible. A staff of three or four persons, familiar only with English and without foreign experience, can never prepare suitable intelligence reports on a global basis. One may marvel at the amount they accomplished, while, at the same time, standing aghast at the limitations of vision, or understanding, of those who imposed such an impossible task upon them without making an adequate staff available. Even after the expansion of the program and the broadening of the linguistic abilities and foreign experiences of the staff, important parts of the program were handicapped by the failure of the higher echelons to appreciate the fact that special abilities were required for the performance of technical jobs. The delay in obtaining a suitable Japanese scholar caused a serious deficiency.

If medical intelligence is worth while—and the writer believes it is—it must be a continuing program during years of peace and not a rush performance begun after war threatens. Its development requires technical knowledge, linguistic capacity, and firsthand knowledge of the area under study. Failure to recognize these obvious facts at the outset of mobilization produced a handicap that was never completely overcome.

Equally obvious was the lesson derived from the efforts of nontechnically trained persons. Reference has been made previously to some of the absurdities produced by persons of good intellect who ventured into the field of medical and sanitary intelligence without proper technical background. Only a few examples were cited; many others were equally ludicrous or pathetic. It is to be hoped that such errors will be avoided in the future and that the need for a centralized and technically competent medical intelligence can be recognized. Well-intentioned but incompetent efforts in this field can be dangerous.

Finally, mention should be made of the difficulties produced by the administrative position of the Medical Intelligence Division. Though conceived and fostered as a part of the Preventive Medicine Service, its true scope was far broader, and, as the months passed, these other aspects of its program became dominant. Its location in preventive medicine became ultimately a handicap to its full development and acceptance. An intelligence unit must serve the entire organization to which it is attached. Had the original plan of the Committee to Study the Medical Department been pursued, and the unit attached directly to the executive office of The Surgeon General, it could have served the Medical Department better. One might even argue that its service to the entire Army might have been greater had it been a part of G-2. There are good reasons to support as well as to oppose such a thesis, but there appear to be few to justify its continuance as a part of preventive medicine.

Great as were its handicaps from an administrative position in the Medical Department, that is, lack of recognition and difficulties of dissemination, no obstacle to effective functioning could compare with its unfortunate relationship to the ASF Intelligence Division. Viewed in retrospect, one may say without hesitation that the chief effect of this latter division upon the medical intelligence program was hindrance of progress. Only on rare occasions did it help to facilitate relations with higher echelons. The staff of the Medical Intelligence Division was forced to spend too much of its time in trying to satisfy the demands of ASF intelligence.

The question of the true value of medical intelligence remains unanswered. To the writer (who can hardly be thoroughly objective because of his close connection with the program), the question must be answered in the affirmative not only because of specific results that it produced but also because of the errors that were apparent when it was ignored. The program had its very obvious defects and limitations. Some of these were of its own making. More were beyond its control and stemmed back to the newness of the ideas. Medical intelligence was developed too late, and in too great a haste, to be of maximum value. The true value of medical intelligence as an integral part of both the intelligence and the medical programs of the Army must rest with the future. Its potential contribution will never be realized, however, unless it finds its proper organizational position, its special needs for technical staff are recognized, and its findings are adequately disseminated to those who are in a position to use such information.

CHAPTER VI

Enemy Prisoners of War

*Stanhope Bayne-Jones, M.D.*¹

This chapter is concerned with policies, programs, operations, and events in activities of preventive medicine for enemy prisoners of war during World War II. The prisoners of war were Italian, German, and Japanese soldiers who had been captured by U.S. Army forces, or transferred to U.S. Army control by British forces. In the former group, the numbers were in the millions; in the latter, there were less than a hundred thousand. Included among the Germans was a small number of Poles, Czechoslovaks, Russians, Danes, Netherlands, Frenchmen, Italians, Turks, Belgians, and Arabs who claimed to have been coerced into the ranks of the German *Wehrmacht*. The captives were taken in the North African and Mediterranean Theaters of Operations (1942-45), the European Theater of Operations (1944-45), the Southwest Pacific Area (1942-45), and the Central Pacific Area (Okinawa, April-June 1945). Most of these prisoners of war were detained in the theaters or areas in which they had been captured. In an unprecedented operation, however, 425,871 Italian, German, and Japanese prisoners of war were transported across the oceans and interned in the continental United States.²

¹ Brigadier General, USAR (Ret.), formerly Deputy Chief, Preventive Medicine Service, Surgeon General's Office, War Department.

² (1) Bibliographic and documentary notes.—In 1955, the Advisory Editorial Board for the "Preventive Medicine in World War II" historical series decided that it would be serviceable to include, in the official history of the Medical Department of the United States Army, a chapter on preventive medicine for enemy prisoners of war since no comprehensive account had been published.

Although there are numerous pertinent records in official files and some narratives of the problems of both captors and prisoners, these accounts are scattered. Many are embedded in other reports without separate indexing of the subject of the health of prisoners of war. Often, the actual conditions are not described or the scenes are blurred. Nevertheless, much hitherto unpublished material was found in the archives of The Historical Unit, U.S. Army Medical Department; Office of the Chief of Military History and Office of The Provost Marshal General, Department of the Army; Federal Records Center, Kansas City, Mo.; and the World War II Division, National Archives and Records Service, Alexandria, Va. Information was enriched and enlarged by interviews with several wartime provost marshals and medical officers who supervised the care of prisoners of war in transit, in enclosures, and in camps. When details from these sources were combined with appropriate portions of histories of commands and field armies and with parts of chapters of other volumes of the official history of the Medical Department of the U.S. Army in World War II, a large amount of relevant and revealing material was assembled.

(2) Acknowledgments.—For an immense amount of assistance in the preparation of this chapter, the author is indebted to members of the staff of The Historical Unit, U.S. Army Medical Department. So many gave so much help that it is not possible in this place to cite the individuals by name.

The author acknowledges with special appreciation the guidance and information given by Brig. Gen. John Boyd Coates, Jr., formerly Director of The Historical Unit, U.S. Army Medical Department, and Editor in Chief of the History of the Medical Department of the U.S. Army in World War II. The type of assistance that he gave was not only that of a chief editor, but also that of a veteran of some of the most important campaigns in the European Theater of Operations, U.S. Army, in World War II. As Executive Officer, Office of the Surgeon, and as Deputy Surgeon, Headquarters, Third U.S. Army, throughout the war, he had the firsthand knowledge of a participant in many of the events with which this chapter is concerned. His informed suggestions and critiques were of great value.

In addition to the hundreds of thousands of enemy prisoners of war in U.S. custody in Europe in 1945, there were other hundreds of thousands of persons in states of destitution and in need of care by the military. There were three groups: recovered Allied military personnel, displaced persons, and refugees. All of these people had to be moved on foot or transported in vehicles and trains in attempts to return them to their homes or countries. They had to be fed, sheltered, supervised medically, controlled hygienically, and policed. These masses of forlorn people added greatly to the burdens and complexities of the tasks that had to be performed by the victorious troops which were engaged in combat during a large part of the time. Although, in general, the problems of handling these groups were similar to those of handling prisoners of war and were solved by applying similar principles, they are considered only secondarily in this chapter. Accounts of the diseases and nutritional disorders found among recovered Allied military personnel, particularly U.S. soldiers recovered from German prison camps in the spring of 1945, have been published in the "Internal Medicine in World War II"³ historical series.

THE GENEVA CONVENTIONS OF 1929

Throughout World War II the treatment of prisoners of war was governed basically by two international agreements: the Prisoner of War Convention⁴ and the Red Cross Convention.⁵

On a similar plane, the author is indebted to Col. Valentine M. Barnes, MPC (Ret.). During 1944-45, Colonel Barnes was Deputy Provost Marshal, Advance Section, Communications Zone, European theater. He had much to do with the handling of German prisoners of war. After the war, when he was a member of the staff of the Military Police School, Camp Gordon, Ga., he compiled a volume of *"Extracts From Military Police Operational Reports, World War II."* This volume is a historical account of the ways in which many of the problems concerning the handling of prisoners of war arose in the field and were solved. During 1961-63, while the author was at work on this chapter, Colonel Barnes was Provost Marshal in the Surgeon General's Office, Washington, D.C. Consultation with Colonel Barnes was frequent and valuable.

Finally, the author is greatly indebted to the following who reviewed a draft of the manuscript and made helpful comments on it: Maj. Gen. Ralph J. Butchers, The Provost Marshal General, Department of the Army, 1960-64; Stetson Conn, Ph. D., Chief Historian, Office of the Chief of Military History, Office Chief of Staff, Department of the Army; Col. Tom F. Whayne, MC (Ret.), during World War II, Director, Medical Intelligence Division, Preventive Medicine Service, Surgeon General's Office, Military Attaché, U.S. Embassy, London, Chief of Preventive Medicine, Office of the Surgeon, Headquarters, U.S. Forces, European Theater, and after the war, Chief, Preventive Medicine Division, Surgeon General's Office; Col. John E. Gordon, MC, AUS (Ret.), during World War II, Chief, Preventive Medicine Division, Office of the Chief Surgeon, Headquarters, European theater; Col. Herbert Pollack, MC, AUS (Ret.), during World War II, member of the staff of the Nutrition Branches in the Offices of the Chief Surgeons, European theater, and U.S. Forces, European Theater; Lt. Col. Charles J. Simpson, MSC, AUS (Ret.), veteran of wartime medical administrative experience with U.S. Army Forces, China-Burma-India, and Executive Officer, The Historical Unit, U.S. Army Medical Department, while this chapter was being completed; Ebbe Curtis Hoff, Ph. D., M.D., and Mrs. Phebe M. Hoff, M.A., Editor for Preventive Medicine, and Assistant Editor, respectively.—S. B.-J.

³ (1) Middleton, William S.: European Theater of Operations. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants. Washington: U.S. Government Printing Office, 1961, pp. 263-264, 452-457, 470-471. (2) Long, Esmond R.: Tuberculosis. In Medical Department, United States Army. Internal Medicine in World War II. Volume II. Infectious Diseases. Washington: U.S. Government Printing Office, 1963, pp. 344-349, 390-392.

⁴ U.S. Treaties, etc., 1929. Prisoners of War. Convention Between the United States of America and Other Powers. Signed at Geneva, July 27, 1929. Washington: U.S. Government Printing Office, 1932. Treaty Series, No. 846, 66 pp.

⁵ U.S. Treaties, etc., 1929. Amelioration of the Condition of the Wounded and the Sick of Armies in the

Legal Status

Through ratification by the President on the advice of the Senate, these two Geneva Conventions acquired statutory authority as integral portions of the laws of the United States of America.

During the 1930's, by processes of ratification appropriate to various countries, these treaties became binding upon many governments, notably, to mention only the principal belligerents of World War II, Great Britain, Canada, Australia, France, Union of Soviet Socialist Republics, Germany, and Italy. Japan ratified the Red Cross Convention on 18 December 1934, but did not ratify the Prisoner of War Convention. The latter received a quasi-official status in Japan when, on 4 February 1942, in answer to an inquiry from the U.S. Government, the Japanese Government stated: " * * * Japan is strictly observing Geneva Red Cross Convention as a signatory state. * * * Although not bound by the Convention relative treatment prisoners of war Japan will apply *mutatis mutandis* provisions of that Convention to American prisoners of war in its power."

Red Cross Convention

In the treatment of prisoners of war, the Red Cross Convention is less significant than the Prisoner of War Convention. It is important, however, for two provisions, as follows: (1) In Articles 9, 10, and 11, it defines protected personnel (medical and sanitary personnel, and chaplains) who had certain privileges after capture, and who could be used by the detaining Power to help care for the enemy sick and wounded prisoners and for sanitary details and work. (2) Article 2 confers the status and rights of prisoners of war upon the sick and wounded in the field and the patients in overrun military hospitals.

Prisoner of War Convention

Although the Prisoner of War Convention of 1929 was imperfect, untried, and soon outranged by the unforeseen developments of the global war of 1939-45, it was an elaboration of principles and regulations embodied in earlier similar conventions which had been applied and tested to some extent. As pointed out by Brig. Gen. Joseph Vincent Dillon, USAF: "The effort of the nations represented at Geneva in 1929 was to make International Law regarding the treatment of prisoners of war and not to draft a set of rules declaratory of existing customary international law. The Convention signed by the delegates on July 27, 1929 was a signal advance in the codification of the law of war."⁶

Field (Red Cross Convention). Convention Between the United States of America and Other Powers. Signed at Geneva, July 27, 1929. Washington: U.S. Government Printing Office, 1932. Treaty Series, No. 847, 37 pp.

⁶ (1) Dillon, J. V.: The Genesis of the 1949 Convention Relative to the Treatment of Prisoners of War. Miami Law Quarterly 5: 40-63, December 1950. [Reprinted by the Department of the Air Force. Washington: U.S. Government Printing Office, 1951.] (2) Interview, Maj. Gen. J. V. Dillon, USAF (Ret.), formerly

The Convention's Concern With Preventive Medicine

While codification of portions of the law of war was a primary contribution of the Prisoner of War Convention of 1929, the convention's content and promulgation of principles and requirements of preventive medicine for enemy prisoners of war made it a principal document among pronouncements in that field. The framers of the convention recognized that the solution of problems of hygiene, broadly conceived, were of vital importance for the physical and moral well-being of prisoners of war as well as for the prevention and control of disease.

Among the 97 Articles of the convention, and the paragraphs of the Annex, approximately 42 Articles contain provisions which may be considered as forming two main divisions, direct and contributory, of a program to prevent moral and physical deterioration, to prevent and control communicable disease, and to maintain health. The *direct provisions* deal with sanitation, environmental and personal hygiene, with food, water, and clothing, and with medical care and supervision. The *contributory provisions* relate to general factors, such as morale, intellectual occupations, rights, humane treatment, fair dealing, personal and official associations, protection of honor, and prospects of repatriation. The grouping of the provisions in direct and contributory categories, somewhat arbitrarily, is presented in the following section.

PREVENTIVE MEDICINE PROGRAM FOR ENEMY PRISONERS OF WAR

The following Articles of the Prisoner of War Convention of 1929 (some presented in full, some in abstract) were those most pertinent to the treatment of prisoners of war in World War II. They outline a comprehensive program of preventive medicine, as follows:

A. Direct Provisions:

Article 9. Prisoners captured in regions unhealthful because of diseases or injurious climate shall be transported, as soon as possible, to more favorable locations.

Article 10. Prisoners of war shall be lodged in buildings or barracks affording all possible guarantees of hygiene and healthfulness.

The quarters must be fully protected from dampness, sufficiently heated and lighted.

In dormitories, with regard to surface area, minimum cubic amount of air, arrangement and material of bedding, the conditions shall be the same as for the troops at base camps of the detaining Power.

Article 11. The food ration of prisoners of war shall be equal in quantity and quality to that of troops at base camps.

Prisoners shall receive facilities for preparing, themselves, additional food which they might have.

Provost Marshal General, North African Theater of Operations (1943-44); Provost Marshal General, European Theater of Operations; and Provost Marshal General, U.S. Forces European Theater (1944-45), 31 Oct. 1962. He was a representative of the United States at the Geneva Conference of 1947, the International Red Cross Conference of 1948, and the Diplomatic Conference at Geneva in 1949, at which meetings the revised, and current, Prisoner of War Convention of 1949 was developed.—S. B.-J.

Prisoners may be employed in kitchens.

All disciplinary measures affecting food are prohibited.

A sufficiency of potable water shall be furnished prisoners of war.

Article 12. Clothing, linen and footwear shall be furnished prisoners of war by the detaining Power. Replacement and repairing of these effects must be assured regularly. Laborers must receive work clothes whenever the nature of the work requires it.

Article 13. The detaining Power shall be bound to take all sanitary measures necessary to assure the cleanliness and healthfulness of camps and to prevent epidemics.

Prisoners of war shall have at their disposal, day and night, installations (latrines) conforming to sanitary rules and constantly maintained in a state of cleanliness.

Prisoners shall be furnished a sufficient quantity of water for the care of their own bodily cleanliness, in addition to baths and showers.

Prisoners shall have opportunity to take physical exercise and enjoy the open air.

Article 14. Every camp shall have an infirmary, where prisoners of war shall receive every kind of attention they need. If necessary, isolated quarters shall be reserved for the sick affected with contagious diseases.

Article 15. Medical inspections of prisoners of war shall be arranged at least once a month. Their purpose shall be the supervision of the general state of health and cleanliness, and the detection of contagious diseases, particularly tuberculosis and venereal diseases.

Article 32. It is forbidden to use prisoners of war at unhealthful or dangerous work.

Article 33. The system of labor detachments must be similar to that of prisoner-of-war camps, particularly with regard to sanitary conditions, food, and attention in case of accident or sickness.

Article 56. The quarters in which prisoners of war undergo disciplinary punishment shall conform to sanitary requirements.

B. Contributory Provisions:

Article 2. Prisoners of war are in the power of the hostile Power, but not of the corps or individuals who have captured them.

They must at all times be humanely treated and protected, particularly against acts of violence, insults and public curiosity.

Measures of reprisal against prisoners of war are prohibited.

Article 3. Prisoners of war have the right to have their person and honor respected; retain their full civil status.

Article 5. No coercion may be used on prisoners to secure information about their army or their country. Prisoners who refuse to answer may not be threatened, insulted, or exposed to unpleasant or disadvantageous treatment; [may not be tortured].

Article 6. Prisoners of war may keep all effects of personal use, including a certain amount of money, identification documents, insignia of rank, decorations, metal helmets and gas masks, [and mess gear].

Article 7. Prisoners of war shall be evacuated to places far enough from the zone of combat to be out of danger; and shall not needlessly be exposed to danger while awaiting evacuation from the combat zone.

Marches on foot must not exceed 20 kilometers a day.

Article 8. Mutual exchange of information about prisoners of war is required between belligerents. [This includes addresses and arrangements for prisoners of war to correspond with their friends and families.]

Article 9. Prisoners of war may be interned in a town, fortress, or enclosed camps; they may not be confined or imprisoned except as an indispensable measure of safety or sanitation. Assembling in a single camp prisoners of different races or nationalities [or of rabid differences of loyalties or opinions] shall be avoided, so far as possible.

Article 12. In all camps there shall be canteens where prisoners of war may obtain, at the local market price, food products and ordinary objects.

Article 16. Prisoners of war shall enjoy complete liberty in the exercise of their religion, * * * on the sole condition that they comply with measures of order and police issued by the military authorities.

Article 17. So far as possible, the detaining Power shall encourage intellectual diversions and sports organized by prisoners of war.

Articles 27-34. Section III (provisions governing utilization of prisoners of war for labor) contains numerous safeguards that have implications for preventive medicine.

Articles 35-41. Section IV (external relations of prisoners of war) provides for correspondence, various types of communication with the outside, and for the receipt of books, newspapers, *food parcels, nutritive supplements, vaccines*, and so forth.

Article 42. Prisoners of war shall have the right to inform the military authorities of the detaining Power, and the representatives of the protecting Powers, with regard to the conditions of their captivity. [This includes the right to complain about unsanitary conditions or undue exposure to disease.]

Article 43. In every place where there are prisoners of war, they shall be allowed to appoint agents entrusted with representing them directly with the military authorities and protecting Powers. [Such representatives could transmit and present complaints, including those relating to sanitary conditions of camps.]

Article 45. Prisoners of war shall be subject to the laws, regulations, and orders in force in the armies of the detaining Power. [This includes the enforcement of medical and sanitary regulations and provides the basis for penalties for infraction of such rules.]

Article 46. Any corporal punishment, any imprisonment in quarters without daylight and, in general, any form of cruelty, is forbidden.

Article 56. Prisoners undergoing punishment shall be enabled to keep themselves in a state of cleanliness, and shall every day be allowed to exercise or stay in the open air at least two hours.

Articles 68, 70-74. Title IV. Termination of Captivity. This contains many salutary provisions which bear on medical care and preventive medicine.

Article 69. Provides for the naming and functioning of *Mixed Medical Commissions*. Each Commission shall be composed of three members, two of them belonging to a neutral country and one appointed by the detaining Power. The function of these Mixed Medical Commissions is to examine sick or wounded prisoners, either on their own initiative or upon request by the prisoner, and to make all due decisions regarding them [including repatriation].

Articles 77-80. Title VI. Bureaus of Relief and Information Concerning Prisoners of War. These provisions bring multiple functions of the International Committee of the Red Cross to bear upon conditions of captivity, including medical and sanitary conditions. They provide also for the establishment by the detaining Power of *Prisoner of War Information Bureaus* with valuable statistical functions, in additions to functions of communication.

It was not until the author assembled the foregoing statements of policy and requirements that he appreciated the depth and range of the program of preventive medicine for prisoners of war that is embodied in the Geneva Convention. Even in condensed form, this program is large; when certain of its provisions are expanded by listing and abstracting the referenced regulations, it takes on the proportions of an army-like system of preventive medicine and public health. For example, such phrases as "af-

fording all possible guarantees of hygiene and healthfulness," and the detaining Power "shall be bound to take all sanitary measures necessary to assure the cleanliness and healthfulness of camps and to prevent epidemics," invoke Army Regulations Nos. 40-205 (Military Hygiene and Sanitation) and 40-210 (Prevention and Control of Communicable Diseases of Man). The requirement that "the food ration of prisoners of war shall be equal in quantity and quality to that of troops at base camps" brings a series of regulations, circulars, and memorandums to bear on the feeding of enemy prisoners of war.

There is, however, an error in the basis of these requirements. They are based upon national standards and not upon absolute standards. A nation having a high standard of living, abundant resources, and advanced ethical views would be required by the terms of the Geneva Convention to treat enemy prisoners of war in its custody according to the standards of maintenance and preventive medicine that it applied to its own troops. On the other hand, an impoverished and backward nation, with low standards, would be permitted to treat its captives on the same deficient basis that it used for its own troops. For the American prisoner of war, the customary Japanese military hygiene and dietary, consisting of uncleanness and a ration of rice and dried fish, or the deficient preventive medicine program and inadequate food allowances of the depleted German Army in 1944-45, were unacceptable and deleterious. In contrast, American standards, when it was possible to apply them, were adequate for the well-being of American-held enemy prisoners of war.

The application of this national standard had an unanticipated and disturbing effect, at times, upon relations among the Allies. In a number of situations in France and Belgium, and even in the United States, the German prisoners of war, fed and cared for according to U.S. Army standards, in compliance with the Geneva Convention, were better fed than the surrounding Allied civilian population that was suffering from food shortages. This led to accusations of pampering the prisoners of war and to complaints against U.S. authorities that were settled only by investigations and much correspondence.

PUBLICATIONS AND DIRECTIVES

To plan and prepare for the handling of prisoners of war, it was necessary to make available, quite widely, information about what had been done in this field in the great wars of the preceding three-quarters of a century, the prevailing national and international policies, and rules and regulations relative to the treatment of prisoners of war. Implementing directives also had to be issued.

Soon after Pearl Harbor, Col. (later Brig. Gen.) Albert G. Love, MC, Surgeon General's Office, U.S. Army, undertook to provide this type of information for the Medical Department. For the convenience of medical

officers and others, his historical account of the development of the two Geneva Conventions, with texts, notes, and commentary, was published in May 1942.⁷

Even earlier than this, the provisions of the Geneva Conventions of 1929, abstracted by The Judge Advocate General, had been incorporated in a War Department field manual on the rules of land warfare and issued in 1940.⁸

During World War II, many manuals, circulars, pronouncements, orders, regulations, amendments, and amendments of amendments, explaining and supplementing the convention relative to the treatment of prisoners of war, were issued by the War Department; the Office of The Provost Marshal General, U.S. Army; commanders of theaters or areas; and subordinate commands. Most of the directives issued by the War Department were concerned with the treatment of prisoners of war held in custody in the continental United States, although Circular No. 1 is entitled broadly: "Regulations Governing Prisoners of War."⁹ Its first sentence is of special interest in showing the respect of the War Department for the powers accorded theater or area commanders and indicating the main reason for the partial lack of centralization of details of prisoner-of-war policy and information in Washington: "These regulations are published for the guidance of those concerned with the military custody of prisoners of war in [the] continental United States, *and will also be applied in theaters outside the continental United States to such extent as is deemed feasible by the theater commanders concerned* [italics added.]"

The multiplicity of directives issued by the War Department and various other governmental organizations in the United States became so great and confusing that it became necessary to reconcile them and bring them together in a single publication. On 5 October 1944, a War Department technical manual¹⁰ accomplished the codification, and this, with some 16 changes through October 1945, guided prisoner-of-war procedures in the continental United States during the last year of the war and in the immediate aftermath.

ORGANIZATIONS FOR HANDLING ENEMY PRISONERS OF WAR

Large resources in men, materials, and organizations were required to handle the hundreds of thousands of prisoners of war captured by U.S. field armies in North Africa, Italy, and Northwest Europe during the campaigns of 1942-45. The forces needed for this work were drawn from several technical services and from various kinds of tactical units.

⁷ The Geneva Red Cross Movement, European and American Influence on Its Development. A compilation with Notes by Albert G. Love. Army M. Bull. No. 62, May 1942. This publication contains the texts of the two Geneva Conventions of 1929 (Red Cross Convention, pp. 116-130; Prisoner of War Convention, pp. 131-165) and the text of the Japanese note (in part, p. 181).

⁸ War Department Basic Field Manual 27-10, Rules of Land Warfare, 1 Oct. 1940.

⁹ War Department Prisoner of War Circular No. 1, 24 Sept. 1943.

¹⁰ War Department Technical Manual 19-500, Enemy Prisoners of War, 5 Oct. 1944.

Contributors to the custodial and professional contingents included: (1) The Office of The Provost Marshal General and its associated Corps of Military Police, (2) the provost marshals and military police under their control at headquarters and communications zones in theaters or areas and in field armies and army groups, (3) the Medical Department, (4) the Quartermaster Corps, (5) the Transportation Corps, (6) the Corps of Engineers, (7) staffs and troops of headquarters from the highest to the lowest echelon, (8) entire infantry divisions (106th and 88th Infantry Divisions), and (9) many artillery, armored, and infantry detachments. Nearly all provided personnel, both specialized and general. Various military organizations supplied food, water, clothing, railroad cars, buses, trucks, ships, airplanes, tents, barracks, structural materials, and buildings. Of the operating agencies just mentioned, those which will be considered most extensively here are (1) the Office of The Provost Marshal General and the provost marshal organizations in the field forces, (2) the Corps of Military Police, and (3) the Medical Department.

The Provost Marshal General and Provost Marshals

In the summer of 1941, the primary responsibility for the handling and treatment of enemy prisoners of war was assigned by the War Department to the Office of The Provost Marshal General,¹¹ newly re-created by order of the President in July of that year. To assist the chief law-enforcement officer of the Army, his office was supported by an organized Corps of Military Police, reactivated on 26 September 1941. As time passed, each Army in the United States, each overseas theater or area, each territorial force, and each major unit of the field forces (divisions, corps, field armies, and army groups) acquired provost marshals and military police units. Among the numerous and varied functions of this entire organization, one of the chief was the handling of enemy prisoners of war.¹²

During the 4 years from 1937 to 1940, more or less active planning in the offices of the War Department Assistant Chief of Staff for Personnel, G-1, and The Judge Advocate General had been concerned with problems that would be presented by the custody of enemy prisoners of war in the event of an outbreak of hostilities in which the United States might be involved. For doctrine, procedures, and precedents, the planners had to depend largely upon the final World War I report of the Provost Marshal General of the American Expeditionary Forces in France, 1918-19, the

¹¹ It is to be regretted that there is no published full-length history of the Office of The Provost Marshal General, or of the activities of provost marshals and military police during World War II. To obtain some comprehension of the system and descriptions of important events in the handling of prisoners of war, the author spent much time in the study of masses of provost marshal records. Unfortunately, there is space in this chapter for only a few notes from that rich historical material.—S. B.-J.

¹² Historical Monograph, Prisoner of War Operations Division, Office of The Provost Marshal General, 1945. [Official record.]

Geneva Conventions of 1929, and derivative publications.¹³ Finally, after an episodic history that had started in 1776, the provost marshal system in the Army was established in its modern and comprehensive form in 1941.¹⁴

In July 1941, the President appointed Maj. Gen. Allen W. Gullion Provost Marshal General, in addition to his other duties as The Judge Advocate General. His office and staff were placed under the War Department Assistant Chief of Staff for Personnel, G-1, pending total Army mobilization.

In addition to the maintenance of law and order in the Army, the control of military traffic, the protection of property, and the prevention and investigation of crime, the Office of The Provost Marshal General also exercised administrative supervision over the enemy alien control program, with special responsibility for the custody of aliens ordered to be interned by the Department of Justice; supervised the internment, care, treatment, labor, and repatriation of prisoners of war held in the continental United States; and maintained the Enemy Prisoner of War Information Bureau and the official information bureau of United States military, naval, and civilian personnel detained by enemy Powers (American Prisoners of War Information Bureau).

In the reorganization of the Army in March 1942, the Office of The Provost Marshal General was brought under the command of Army Service Forces. Thereby, like The Surgeon General, The Provost Marshal General lost most of his higher staff standing. His office then functioned as a staff agency under the Commanding General, Army Service Forces, who had been charged with all matters pertaining to enemy prisoners of war in custody in the continental United States. Until 25 June 1945, The Provost Marshal General reported to the Deputy Chief of Staff, Army Service Forces, meanwhile retaining to a considerable extent harmonious and helpful relations with the War Department Assistant Chief of Staff for Personnel, G-1.

By April 1944, the Office of The Provost Marshal General included 10 divisions and 17 branches. Among them were a Prisoner of War Operations Division, which contained a Medical Liaison Branch linked to the Office of The Surgeon General for matters related to prisoners of war in U.S. custody in the continental United States;¹⁵ a Military Police Division; and a Military Government Division, which administered the School of Military Government, Charlottesville, Va. This school contributed importantly to the operations of the Civil Affairs Division, War Depart-

¹³ (1) War Department Basic Field Manual. Volume IX. Military Police. Washington: U.S. Government Printing Office, 1938; revised and reissued as War Department Basic Field Manual 19-5, Military Police, 14 June 1944. (2) See footnote 8, p. 348.

¹⁴ Lewis, George G., and Mewha, John: History of Prisoner of War Utilization by the United States Army, 1776-1945. Department of the Army Pamphlet No. 20-213, 24 June 1955.

¹⁵ Juchli, Rene H.: Record of Events in the Treatment of Prisoners of War, World War II, September 1945. [Official record.]

ment Special Staff; had a close relationship with the Preventive Medicine Service, Surgeon General's Office; and trained many civil affairs officers for service in overseas theaters or areas. Neither The Provost Marshal General nor The Surgeon General included in his office branches or sections designed and staffed to deal centrally with hygiene, sanitation, and preventive medicine for enemy prisoners of war in theaters or areas.

The Corps of Military Police

Soon after its establishment in September 1941, the Corps of Military Police was organized as a part of the Office of The Provost Marshal General, which, under higher staff direction, formulated military police policy for the Army as a whole and supervised the technical training and functions of the Corps of Military Police in all parts of the world.

The units of the Corps of Military Police which were particularly concerned with the handling of enemy prisoners of war were the military police battalion, the military police escort guard company, and the military police prisoner-of-war processing company. The tables of organization and equipment¹⁶ allowed these units personnel and equipment for guard duties and for processing, but did not provide for any sanitary or medical personnel and equipment beyond elements needed to care for the unit itself. They made no allowance for the extra medical and sanitary formations required for a preventive medicine program for enemy prisoners of war, in transit or in enclosures, as outlined in the Geneva Convention, and as mentioned briefly in the military police field manual.

The same can be said about the lack of provisions for transportation of enemy prisoners of war in the field. In the tables of organization and equipment for the Corps of Military Police, there were few motor vehicles beyond those needed for the particular military police unit itself that could be used to move prisoners of war along the lines of evacuation to the rear areas. Dependence had to be placed upon assignments (including boxcars and gondola freight cars) from the Transportation Corps or upon trucks belonging to other units returning to supply depots. These arrangements were often uncertain and inadequate, often frustrating, and generally exhausting.

From three battalions and four separate companies in September 1941, the Corps of Military Police grew to a peak strength of 200,000 enlisted men and 9,250 officers in June 1945. The portion of this force that could be assigned to the European Theater of Operations, U.S. Army, was not large enough to handle the hundreds of thousands of prisoners of war captured in the European theater in 1944 and 1945. It became necessary to draw reinforcements from combat troops, much to their displeasure and disgust, and to some degree of disregard of the humane

¹⁶ War Department Tables of Organization and Equipment Nos. 19-35, 19 Aug. 1943; 19-47, 25 Nov. 1943; 19-55, 27 Nov. 1943; 19-57, 27 Nov. 1943; 19-237, 18 Nov. 1943; 19-7, 12 Sept. 1944; 19-500, 22 Apr. 1944, and C1, 25 Sept. 1945.

policies of the Geneva Convention. The use of combat troops to guard and escort enemy prisoners of war was sanctioned, of necessity, in situations in which the captures were en masse. It was generally recognized, however, that such assignments were unwise and should be avoided as much as possible.

The system of collection and evacuation of enemy prisoners of war was devised in the planning stage before the United States entered World War II. Modified by experience, it was utilized during the war especially in the European theater. Its essential features are outlined in chart 6.

In the frontline areas, combat troops conducted their captured enemy prisoners of war to regimental and divisional collecting points where they were turned over to Army military police. A few selected prisoners were evacuated from divisional collecting points to a corps prisoner-of-war cage by corps military police and retained, for a time, at corps headquarters for interrogation. The mass of prisoners were taken from divisional collecting points by personnel of Army military police escort guard companies to an Army enclosure. (Or, in 1945, they were also taken to Prisoner of War Transient Enclosures. These transient enclosures are not shown in chart 6, but are indicated in map 8 (p. 384).) At these collecting points, they were processed as thoroughly as possible. Occasionally, prisoners of war were held in these enclosures for several weeks. Evacuation of prisoners from Army enclosures, or from Central Prisoner of War Enclosures in base sections, to ports in the communications zone, and to ports and camps in the Zone of Interior, was carried out in part by Army military police and in part by Zone of Interior military police. Movement was by bus, truck, rail, and ship, and occasionally by air, according to the situation.

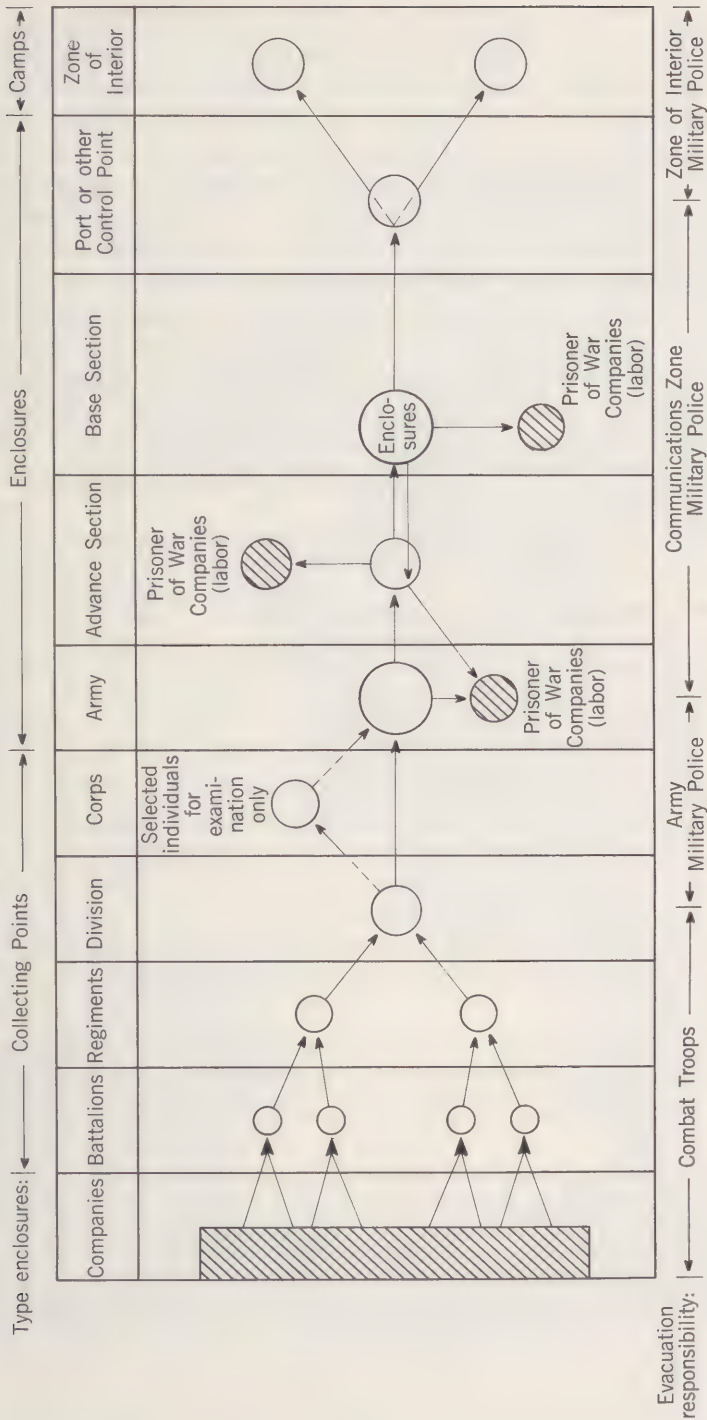
Medical Department Activities

Units and individuals of the Medical Department of the U.S. Army were detailed to prisoner-of-war enclosures or to base and branch camps at home and abroad. Sometimes U.S. medical personnel rendered medical care to prisoners of war. Usually, they assisted or supervised and directed captured German medical and sanitary personnel in the care of the sick, wounded, and injured enemy prisoners of war, and in the operation of some type of preventive medicine program. At times, medical groups¹⁷ which could be moved about readily, as well as parts of medical sections of combat units, were employed in the field to render medical and sanitary services to enemy prisoners of war. Chief surgeons of theaters or areas and their preventive medicine officers were among the authorities who were directly concerned with these matters.

In the Office of The Surgeon General, in addition to auxiliary services,

¹⁷ War Department and Department of the Army Table of Organization and Equipment No. 8-22, Headquarters and Headquarters Detachment, Medical Group, 20 May 1943 and 31 Jan. 1949.

CHART 6.—Diagram of system of collection and evacuation of enemy prisoners of war



valuable activities for the health and welfare of enemy prisoners of war were carried out by the Hospital Administration Division and the Preventive Medicine Service. In the Hospital Administration Division, there was a Medical Liaison Unit¹⁸ linked to the Office of The Provost Marshal General, with Maj. (later Lt. Col.) Rene H. Juchli, MC, as chief, charged with dealing with innumerable and complicated affairs of enemy prisoners of war in the custody of the United States who were being held in the continental United States. In the Preventive Medicine Service, several branches at various times dealt with special conditions among enemy prisoners of war overseas and in the United States. These matters included infectious diseases that might be introduced into the country by prisoners of war; a survey of immunizations that German captives may have received as protection against possible biological warfare agents; malaria control at prisoner-of-war camps in the Southern United States; and a host of procedures relating to water supply, hygiene, sanitation, and nutrition.

NORTH AFRICAN THEATER OF OPERATIONS

Casablanca to Tunis, 8 November 1942 to 13 May 1943

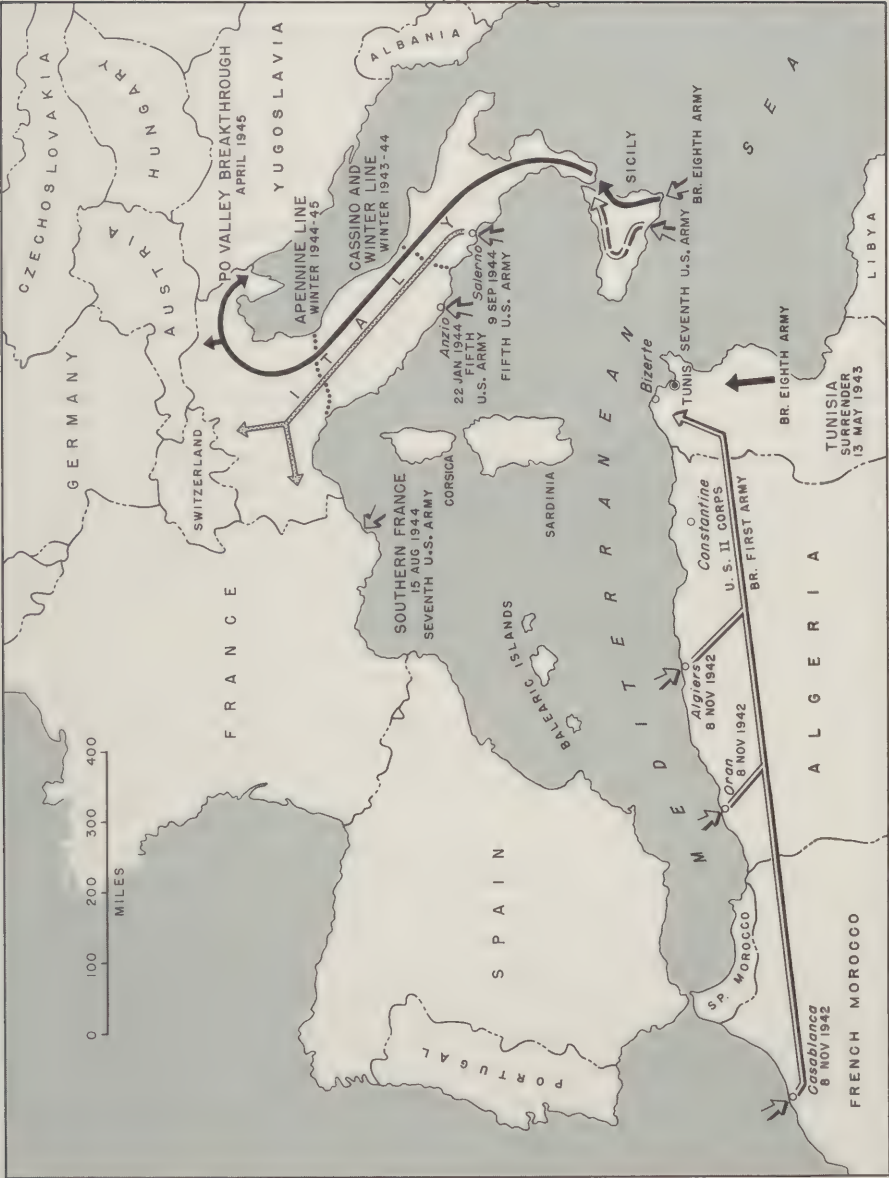
In the North African Theater of Operations,¹⁹ U.S. Army forces experienced their first massive commitments in World War II²⁰ (map 6). From the landings at Casablanca, Oran, and Algiers on 8–10 November 1942 to the liberation of Tunis on 13 May 1943, the American soldier experienced a rough apprenticeship in mid-20th century warfare. It was full of severe trials, unexpected complications, and lessons for all arms and services. In its final victorious phase, it included the sudden capture of masses of enemy prisoners of war. More than a quarter of a million Italian and German soldiers were captured within about a week, producing conditions in which practicalities often transcended planning and demands exceeded resources. These conditions presaged events which were to occur later in other theaters.

Actually, two campaigns were fought in Northwest Africa during this period: "Operation TORCH which swiftly liberated French North Africa from Vichy French control, followed by a longer Allied effort to

¹⁸ See footnote 15, p. 350.

¹⁹ On 8 November 1942, when Allied forces invaded North Africa, the region of concern to the U.S. task force was a part of the European Theater of Operations, U.S. Army. The controlling organization was Allied Force Headquarters until 4 February 1943 when the theater became jointly administered, and the North African Theater of Operations, U.S. Army, was established. Among the areas included in the North African theater were Northwest Africa, Sicily, and portions of the Mediterranean Sea. On 1 November 1944, the theater was renamed the Mediterranean Theater of Operations, U.S. Army, and was enlarged to include Greece, the Balkans, and all of the Mediterranean Sea. On 20 November 1944, base sections in southern France were transferred from the Mediterranean theater to the European theater. Early in 1945, the Mediterranean theater was further diminished by the assignment of its African territory to the Africa-Middle East Theater. On 1 October 1945, Allied Force Headquarters was separated from the Mediterranean theater and ceased to function.

²⁰ Howe, George F.: *Northwest Africa: Seizing the Initiative in the West*. United States Army in World War II. The Mediterranean Theater of Operations. Washington: U.S. Government Printing Office, 1957.



MAP 6.—Campaigns in the North African and Mediterranean Theaters of Operations, U.S. Army, 1942-45.

destroy all the military forces of the Axis powers in Africa. The latter concentrated in Tunisia, where the front at one time extended more than 375 miles, and fighting progressed from scattered meeting engagements to the final concentric thrust of American, British, and French ground and air forces against two German and Italian armies massed in the vicinity of Bizerte and Tunis.”²¹ Following the breakthrough, the cleanup was so complete General Dwight D. Eisenhower could later write that, “except for a few stragglers in the mountains, the only living Germans left in Tunisia were safely within prison cages.”²² The conditions and management of those prison cages and their inmates will be the main topics of this section of the chapter.

Transfer of prisoners of war to the continental United States.—Early in 1942, an agreement was made between Great Britain and the United States that some 150,000 British-captured prisoners of war (Italian and German) then being held in Great Britain would be interned in the continental United States to lighten a burden that was hard for the British to carry. Later in the same year, as the campaign progressed, all prisoners of war captured in Northwest Africa became, by agreement, American controlled.²³ General Eisenhower desired to relieve the North African theater of the drain upon its resources of food, shelter, shipping, and personnel imposed by the requirements of caring for thousands of prisoners of war. The transfers were made, and thereby a special portion of the operation of the preventive medicine program for enemy prisoners of war was shifted to the continental United States. The consequences of this transfer of prisoners are described later (p. 411).

Prisoners of war captured to 14 April 1943.—Captures of German and Italian prisoners by the Allied Task Force as it fought its way from Casablanca to Tunis were few in number. Of this period, General Omar N. Bradley wrote: “* * * we had counted ourselves fortunate in capturing a dozen of them at a time.”²⁴ After 1 January 1943, in Tunisia, the captures increased sporadically. Expressing the figures in round numbers, it was reported that the British took 7,000 prisoners of war at the Mareth Line on 29 March and another 7,000 at Akarit wadi on 7 April, and that the French took 1,000 at Kairouan on 10 April. The U.S. 1st Infantry Division captured 700 prisoners at El Guettar and the 1st Armored Division another 700 at Maknassy Pass, during the period 17–25 March. The total number of enemy prisoners of war captured on all fronts in North Africa from 20 March to 14 April 1943 was estimated to be 28,000 (6,000 Germans and 22,000 Italians). Most of these prisoners were evacuated to incompletely

²¹ Howe, George F.: *Northwest Africa: Seizing the Initiative in the West. United States Army in World War II. The Mediterranean Theater of Operations.* Washington: U.S. Government Printing Office, 1957, p. vii.

²² Eisenhower, Dwight D.: *Crusade in Europe.* Garden City, New York: Doubleday & Co., Inc., 1949, p. 157.

²³ Lewis, George G., and Mewha, John: *History of Prisoner of War Utilization by the United States Army, 1776–1945.* Department of the Army Pamphlet No. 20–213, 24 June 1955, p. 83 and fn. 43, p. 90.

²⁴ Bradley, Omar N.: *A Soldier's Story.* New York: Henry Holt & Co., 1951, p. 98.

constructed and inadequately sanitized enclosures, cages, or camps located along the Mediterranean coastal area in the vicinities of headquarters of Atlantic, Mediterranean, and Eastern Base Sections. It was a time when there were shortages of supplies and confusion in distribution of supplies for U.S. troops. It was to be expected that enemy prisoners of war would be subjected to the same fateful deficiencies. It must be admitted, however, that not as much was done as might have been done to provide more nearly adequate preventive medicine services for these prisoners.

Preventive medicine planning for prisoners of war.—With a clear foresight of coming events and problems, Lt. Col. (later Col.) Perrin H. Long, MC, Chief Consultant in Medicine, Allied Force Headquarters, and North African theater, wrote a vigorous memorandum for the theater surgeon, Brig. Gen. Frederick A. Blessé, on 18 March 1943, on "Prevention of Disease in Prisoners of War."²⁵ The essential contents of Colonel Long's memorandum follow:

1. Colonel Long pointed out that the coming battle in Tunisia would put a heavy strain upon existing medical and sanitary arrangements and facilities in the U.S. Army, because in addition to the care of the sick and wounded, the Army medical service would be charged with the prevention of disease among captured enemy troops. The burden was expected to fall mainly upon the U.S. Army component of the Allied Task Force because the current plans called for the evacuation of prisoners of war along American lines of communication. This plan was changed somewhat in the first part of May 1943, when, in the battle for northern Tunisia, initial responsibility for supervision of prisoners of war was placed upon the British.

2. "Every effort must be made to prevent the outbreak of epidemic disease among the anticipated prisoners of war not only because of the humane aspects of the problem, but also because of the dangers to our own forces which would be created by such outbreaks."

3. Knowledge about the status of immunizations in enemy troops was scanty, although there were reports from nonmilitary sources that the Germans had been vaccinated against typhoid, typhus, and smallpox; the Italians had been vaccinated against typhoid, tetanus, and smallpox.

4. The three main health problems which would concern prisoners of war were noted to be typhus, malaria, and dysentery. Information about the occurrence of these diseases in enemy troops in action, and after capture, was summarized and discussed. Preventive measures, as used for the protection of U.S. troops, were advised for prisoners of war, with some modifications to fit circumstances. Against typhus, the major measures were to be delousing with insecticide powder and vaccination with Cox-type rickettsial vaccine. Mosquito control, coupled with suppressive Atabrine therapy, was recommended against malaria. With regard to dysentery prevention, a truism was stated: "Due to the necessarily exposed conditions of prison camps, the lack of sanitary facilities, and the impossibility of screening cook shacks and messhalls, it is likely that dysentery will be a problem among prisoners of war. To offset this threat, a most rigid and severe sanitary discipline must be enforced in all prison camps in respect to the disposal of human excreta and every effort must be made to remove fly breeding sources from the environs of prison camps to a distance of at least one and one-half miles.

²⁵ Long, Perrin H.: Mediterranean (Formerly North African) Theater of Operations. In *Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants*. Washington: U.S. Government Printing Office, 1961, pp. 193-195.

Even if such measures are enforced it is likely that a considerable amount of dysentery will occur * * *—a prediction amply verified by experience!

Medical care for prisoners of war.—In another memorandum, dated 19 March 1943, to the Surgeon, North African theater, on "Professional Services for Prisoners of War,"²⁶ Colonel Long pointed out that to reduce the demands for medical care of the sick "every effort should be made to initiate preventive measures * * * for prisoners of war." Furthermore, he advised that "medical officers be detailed to each secondary forward concentration area to initiate and supervise sanitary and preventive procedures and to look after the health of prisoners."

Unfortunately, this enlightened advice was frustrated by neglect or could not be carried out in some instances because of the swift capture of many thousands of prisoners whose mere numbers swamped all facilities for their sanitary care. There were also troubles in communications. Colonel Long records that "by some accident of fate, instead of their [these memorandums] being returned to the surgeon's office they were buried in the records section of the Adjutant General's Office, AFHQ, and no action was taken upon the recommendations made in them. By May 1943, the battle for northern Tunisia was well under way [as well as the season for flies and mosquitoes], and prisoners of war began to stream in by the thousands."

In the closing days of the campaign in northern Tunisia, the Chief Consultant in Medicine, North African theater, noted that the recommended measures for the prevention of disease among prisoners of war were being disregarded by both British and American forces, and that little use was being made of enemy medical officers and sanitary personnel (protected personnel) for the care of their own nationals. He reported these conditions to the Provost Marshal General, North African theater, on 17 May 1943, and advised that increased numbers of "protected" enemy personnel be retained "to assist in the prevention of disease and the care of the sick and wounded in prison compounds." He urged, further, that prisoners of war be given a stimulating dose of TAB vaccine and be placed on Atabrine therapy for the suppression of malaria.

Prisoner-of-war enclosure at Mateur.—The most famous, and notorious, prisoner-of-war enclosure in northern Tunisia was located just north of Mateur (captured on 3 May 1943) on the farmyard plain at the foot of Djebel Achkel. A photograph (fig. 32) of the crowding there on the unsheltered sand on 9 May is more expressive than many words. These men were a large portion of the 275,000 prisoners that were captured by the Allies in the last week of the fighting in Tunisia.

In spite of the overflow of defeated Axis soldiers, some efforts at preventive medicine were made, even in the teeming barbed wire enclosure

²⁶ Long, Perrin H.: Mediterranean (Formerly North African) Theater of Operations. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants. Washington: U.S. Government Printing Office, 1961, pp. 196-197.



FIGURE 32.—Aerial view of German prisoner-of-war enclosure west of Mateur, Tunisia, North Africa, 9 May 1943. (U.S. Army photograph.)

at Mateur. General Bradley,²⁷ who watched the scene unfold, wrote, as follows:

* * * We anticipated 12,000 or 14,000 PWs. By nightfall, however, the Germans had overrun our cages. German engineers were conscripted under their own noncoms to expand the enclosure. We doubled and soon tripled that original compound.

For two days, as far as one could see, a strange procession of PWs trailed up the road from Mateur as though on a holiday junket.

Some came in long convoys of GMC's guarded only by an occasional MP * * * atop each cab with a rifle. [As in the European theater, most of the prisoners were so docile that they did not need guards, but guides to the enclosures.] Others traveled in giant sand-colored Wehrmacht trucks bearing the palm-tree markings of the Africa Korps. On bicycles, farm carts, motorcycles, gun carriages, even burros, they trailed contentedly toward the cages. By the time this flow thinned down we had counted 40,000.

* * * * *

A carnival air soon pervaded the Italian cages as the PWs squatted round their fires and sang to the accordions they had brought in with them. In contrast, the Germans busied themselves in tidying up the compound. Noncoms issued orders and soon colonies of camouflaged ponchos mushroomed on the desert floor. The men were

²⁷ Bradley, Omar N.: *A Soldier's Story*. New York: Henry Holt & Co., 1951, pp. 97-98.

formed into companies, latrines excavated, cooking areas assigned them, and water rationed from Lyster bags. German quartermasters trucked tons of their own rations into the cages.

However, the latrines could not be covered and protection against flies and mosquitoes was feeble. Soon dysentery, hepatitis, and malaria became major causes of sickness, which under the circumstances could not be prevented.

Problems of handling large numbers of prisoners of war.—When General Eisenhower saw something of the handling of hordes of enemy prisoners of war in the European theater in 1945, he recalled “the time in Tunisia when the sudden capture of 275,000 Axis prisoners caused me rather ruefully to remark to my operations officers, Rooks and Nevins: ‘Why didn’t some staff college ever tell us what to do with a quarter of a million prisoners so located at the end of a rickety railroad that it’s impossible to move them and where guarding and feeding them are so difficult.’ ”²⁸

On more than one occasion during World War II, surgeons, preventive medicine officers, and provost marshals uttered the same cry. To the author, it seems fair to say that, while all the disease-producing conditions associated with prisoners of war, enclosed as herds and evacuated in droves, could not have been prevented, their frequency could have been reduced by more imaginative forecasts, clearer planning, and sharper indoctrination at all levels, including the Army War College—the post-graduate school of the Army.

From May to July 1943, the evacuation of prisoners of war captured in Tunisia continued westward slowly along the coastal roads, highways, and railroads from the Eastern Base Section in the Constantine area. By the first week in June, they were arriving by the thousands in the ill-prepared compounds in the Mediterranean and Atlantic Base Sections. Bringing dysentery with them, the prisoners polluted roadsides and stations with infected excrement. Traveling hosts of malarial parasites, they were potential new reservoirs of paludism and intensified problems of malaria control.

Preparation for the Sicilian Campaign.—During this period, the theater was preoccupied not only with rehabilitation after the Tunisian Campaign, but also with the enormous task of planning and preparing for the invasion of Sicily. Under the North African theater, the planning for this campaign (Operation HUSKY), to be based in North Africa, began in February 1943. Even before the end of the fighting in Tunisia, and continuing to the taking of Messina on 17 August 1943, the area of the North African theater, particularly along the coast of the Mediterranean Sea, became a very large and busy training ground for air and amphibious assault and the storage arsenal for much of the ground, air, and naval

²⁸ Eisenhower, Dwight D.: *Crusade in Europe*. Garden City, New York: Doubleday & Co., Inc., 1949, p. 386.

equipment and supplies. Naturally, these matters took precedence over some considerations of preventive medicine for enemy prisoners of war already in the theater.

In view of the just cited facts, and since most of the Italian and German prisoners of war captured later in Sicily were evacuated to North Africa, it is advisable to turn now to a brief review of some aspects of the Sicilian Campaign, and to return later to an additional description of prisoner-of-war conditions in North Africa during a period after the completion of the invasion of Sicily (p. 363).

Sicily—Gela to Messina, 10 July to 17 August 1943

The campaign in Sicily lasted from the landings of American and British forces on 10 July 1943, on the southern and southeastern portions of the island, to the taking of Messina on 17 August 1943—38 days. It was a hard-fought campaign, bravely and brilliantly carried out by the Seventh U.S. Army under General George S. Patton, Jr., the British Eighth Army under General Sir Bernard L. Montgomery, and by strong bodies of American and British naval and air forces. A total of 122,204 prisoners of war were captured.²⁹

During the Sicilian Campaign, the most notable event that affected the status of Italian prisoners of war was the fall of Mussolini on 25 July 1943 and the surrender of Italy announced by General Eisenhower on 8 September 1943. Thereafter, when some prolonged and difficult negotiations with Badoglio had been completed, Italy was recognized as a co-belligerent with the Allies, and her captured military personnel became organized into Italian Service Units. The members of these units were eligible for all of the rights and privileges provided by the Geneva Conventions of 1929, as if they were still in the status of prisoners of war. On the other hand, they had considerable freedom. These units rendered valuable services in labor, agriculture, and industry, and assisted in specialized activities, such as the care of the sick and wounded in hospitals and as sanitary police in prisoner-of-war camps.

During the campaign in Sicily, neither Allied nor Axis troops encountered problems of field or camp sanitation and preventive medicine that were basically different from those which had been met in Northwest Africa. Problems of handling enemy prisoners of war by U.S. forces were similar to those of the North African Campaign. An example of this was the shortage of drinking water for prisoners of war (fig. 33).

The chief newly encountered disease in Sicily was sandfly fever (pappataci fever).³⁰ Not recognized at first, several hundred cases of this

²⁹ Report of Operations of the United States Seventh Army in the Sicilian Campaign, 10 July–17 August 1943.

³⁰ Hertig, Marshall, and Sabin, Albert B.: Sandfly Fever (Pappataci, Phlebotomus, Three-Day Fever). In Medical Department, United States Army. Preventive Medicine in World War II. Volume VII. Communicable Diseases. Washington: U.S. Government Printing Office, 1964, pp. 109–174.



FIGURE 33.—Italian prisoners of war captured by the 3d U.S. Infantry Division, Seventh U.S. Army, in Sicily, waiting in line for water at a prisoner-of-war enclosure, 8 August 1943. (U.S. Army photograph.)

disease were diagnosed as “fever of undetermined origin,” “three-day fever,” or malaria. It caused much noneffectiveness. Control, not entirely satisfactory, was based upon attempts to avoid the bite of the vector, *Phlebotomus papatasi*, by the use of insect repellent, and by the use of fine-mesh screening. Sandfly fever was occurring in prisoners of war when they were evacuated to North Africa, but the disease was not a continuing problem there.

Malaria, especially prevalent in the Catanian plain facing the southeastern bastion of Mount Etna, caused relatively heavy losses among troops on both sides. Infected prisoners captured in malarious areas carried parasites into prisoner-of-war enclosures across the seas.

Preparations for handling prisoners of war.—At the beginning of the Sicilian Campaign, the preparations for the reception and handling of prisoners of war evacuated to the Eastern Base Section were still primitive,

according to a report to the Surgeon, North African theater, by the Chief Consultant in Medicine, on 25 August 1943, as follows:³¹

* * * When the first prisoners of war arrived, the stockades were half completed, latrine pits not dug, latrine boxes not flyproofed, kitchen facilities and waste disposal were primitive, water and rations were short, delousing facilities were lacking, medical supplies were short, one medical officer was in the area, and a battalion of the 135th Infantry had to be used to guard prisoners because but a handful of the P.M. [Provost Marshal] representatives were available. The POW (especially the Italians) arrived exhausted and ill with dysentery and malaria. Scabies was frequent and venereal diseases were not uncommon. They were herded off the LST's (on which water was frequently short), lined up in the hot sun, and then marched along the main roads to the POW compound. * * * En route many fell out from heat exhaustion or from other causes. On one occasion a large group of POW burst through their road guards like a bunch of wild animals and practically threw themselves into a badly contaminated well, so great was their thirst. Such conditions [of stress] were undoubtedly responsible for the lighting up of chronic malarial infections in the prisoners, with the result that they took up hospital beds in the Bizerte-Mateur area which otherwise would have been available for use by American patients.

At the Mediterranean Base Section (Oran area), from May to October 1943, diarrhea and dysentery were prevalent among both U.S. troops and prisoners of war. In addition, the increase of lice among the prisoners was appreciable. Improvements, however, were in the making. Col. Myron P. Rudolph, MC, the base surgeon, was able to report that: "As supplies became available and as proper control could be exercised the standards gradually improved. Towards the end of 1943 the general sanitation and living conditions [in POW compounds] were approximately as good as among MBS troops."³²

From September 1943 to the end of the year, the handling and treatment of enemy prisoners of war detained in North African base sections constantly improved.

Diseases among prisoners of war.—The available statistics are not sufficient to disclose all that one would like to know about morbidity and mortality among prisoners of war captured in Tunisia and Sicily and detained in North Africa. Although rates cannot be calculated, the numbers of reported cases of various diseases give interesting indications of at least a recorded portion of the experience. These data, extracted from the reports of Colonel Long and others, are presented in table 19. Other causes of mortality among these prisoners were: wounded in action, 12; hypertension, 1; brain abscess, 2; dermatitis exfoliativa (arsenical), 1; nephritis, acute, 1; colitis, amebic, 1; colitis, ulcerative, 1; carcinoma, 1; dehydration and exhaustion, 2; coronary thrombosis, 4; suicide, 1; killed by guards, 8; accident, 1; ruptured appendix, 1.

³¹ Long, Perrin H.: Mediterranean (Formerly North African) Theater of Operations. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants. Washington: U.S. Government Printing Office, 1961, pp. 199-200.

³² Annual Report, Surgeon, Headquarters, Mediterranean Base Section, North African Theater of Operations, U.S. Army, 1943, p. 18.

TABLE 19.—*Morbidity and mortality from disease among enemy prisoners of war captured in the Tunisian and Sicilian Campaigns and hospitalized in North Africa between 15 June and 15 September 1943*

Disease	Cases	Deaths
Diphtheria.....	21	2
Dysentery.....	827	
Fever of undetermined origin (probably sandfly fever).....	411	
Jaundice (infectious hepatitis).....	115	1
Malaria (predominantly vivax).....	2,095	24
Pneumonia.....	3	3
Pneumonia, primary atypical.....	38	
Smallpox.....	2	
Tuberculosis.....	42	2
Typhoid fever (including paratyphoid).....	21	3
Typhus.....	2	

Source: Long, Perrin H.: *Mediterranean (Formerly North African) Theater of Operations. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants.* Washington: U.S. Government Printing Office, 1961, pp. 200-202.

In commenting on these statistics, Colonel Long³³ noted that: (1) The case fatality rate from malaria in prisoners of war (1.14 percent) was considerably higher than the rate observed in American troops. (2) Two great causes of morbidity (malaria and dysentery) could have been markedly reduced if adequate preparations for the reception and care of prisoners of war had been made. (3) The following figures (which are based upon average periods of hospitalization noted for American patients) are presented to show the number of hospital-bed days taken up by prisoners of war sick with preventable diseases:

Malaria.....	31,425
Dysentery.....	4,135
Typhoid fever.....	745

In conclusion, it was the judgment of the Chief Consultant in Medicine, North African theater, that the record of the prevention and treatment of disease among prisoners of war was fair.

MEDITERRANEAN (FORMERLY NORTH AFRICAN) THEATER OF OPERATIONS

Rarely, if ever, has a flank attack been so large, powerful, sustained, and successful as the Italian Campaign of the Fifth U.S. Army³⁴ and the British Eighth Army, from August 1943 to May 1945. Although called a secondary theater of operations in comparison with the European theater,³⁵

³³ Long, Perrin H.: *Mediterranean (Formerly North African) Theater of Operations. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants.* Washington: U.S. Government Printing Office, 1961, p. 202.

³⁴ Fifth Army History, Parts I-IX, 1946.

³⁵ Eisenhower, Dwight D.: *Crusade in Europe.* Garden City, New York: Doubleday & Co., Inc., 1949, p. 190.

this campaign contributed mightily to the defeat of Germany and to the winning of the war in Europe.³⁶

The Italian Campaign, lasting approximately 22 months, included two bitter winters. Under the command of Lt. Gen. Mark W. Clark from August 1943 to December 1944, and thereafter under Lt. Gen. Lucius K. Truscott, Jr., the Fifth U.S. Army fought northward along the mountainous length of Italy. It was opposed stubbornly by large skillful German forces, fully and appropriately equipped, well-supplied, ably led, and usually so dug in or protected by buildings and caves, rivers and cliffs, that they had to be destroyed in place or forced to withdraw. This was so until the final weeks of their collapse and total defeat (map 6, p. 355).

German Prisoners of War in Italy

Number captured.—Relatively few prisoners of war were taken by the Fifth U.S. Army along the route from Salerno in southern Italy to Bologna, one of the gateways to the Po River Valley, in the northern Appenines, during the period from September 1943 to April 1945. In the latter month, the trickle of enemy prisoners of war became a deluge of thousands, including large numbers of patients in overrun German military hospitals. This followed the surrender of the German forces on 2 May 1945, by General der Panzertruppen Heinrich von Vietinghoff genannt Scheel, who, on 23 March 1945, had succeeded Feldmarschall Albert Kesselring as supreme commander of the Nazi forces in Italy. The intake of German prisoners of war by the Fifth U.S. Army from 4 January 1944 to 6 May 1945 is shown in table 20.

All prisoner-of-war enclosures in northern Italy became overcrowded and sanitary conditions temporarily foul, placing a great strain upon the medical and related components of the victorious army. The severe problem of handling masses of enemy prisoners of war fell upon the Fifth U.S. Army after the hard fighting was over and the war in Europe was coming to its end.³⁷

As the Italian Army had surrendered on 8 September 1943, no Italians were taken as prisoners of war after that date.

Prisoner-of-war enclosures.—The chief prisoner-of-war enclosures in Italy were in the Naples-Foggia area in the Peninsular Base Command; in the areas of Caserta, Rome, Florence, and Leghorn; and after Bologna, at Ghedi, Cortina d'Ampezzo, Bolzano, Merano, and Verona. In May 1945 and later, the largest enclosures were at Ghedi, just southwest of Lake Garda, and at Merano, northeast of the lake on the route to the Brenner Pass.

³⁶ (1) Blumenson, Martin: Salerno to Cassino. United States Army in World War II. The Mediterranean Theater of Operations. Washington: U.S. Government Printing Office, 1969. (2) Fisher, Ernest F., Jr.: Cassino to the Alps. United States Army in World War II. The Mediterranean Theater of Operations. [In preparation.]

³⁷ See footnote 34, p. 364.

TABLE 20.—*Prisoners of war (German) captured by the Fifth U.S. Army in Italy from 4 January 1944 to 6 May 1945*

Period		Number
1944		
4 Jan.-9 Mar		6,657
12 May-2 June		11,316
10 Sept.-22 Oct		7,074
Total		25,047
April: 1945		
1		9
2		0
3		29
4		6
5		40
6		97
7		96
8		148
9		77
10		75
11		53
12		380
13		491
14		455
15		697
16		495
17		1,460
18		1,266
19		1,053
20		2,325
21		1,886
22		1,915
23		5,610
24		19,653
25		3,791
26		2,614
27		7,324
28		4,411
29		10,211
30		21,526
Total		88,193
May:		
1		17,835
2 (German surrender)		41,735
3		6,847
4		4,036
5		320
6		2,343
Total		73,116
Grand total		186,356

Source: Fifth Army History, Part IV, pp. 225-229; Part V, pp. 215-219; Part VII, pp. 220-223; Part IX, p. 174, 1946.

Some of the German prisoners of war were organized into service units (labor units), and were carefully nurtured to keep them fit for hard work. Others were evacuated through Naples to base sections or hospitals in North Africa or to the United States.

The retention in the communications zones in the North African-Mediterranean theater of German prisoners of war captured during the Italian Campaign does not appear to have caused serious problems of either supply or sanitation. Constant effort was made to observe the Geneva Conventions of 1929, and a degree of preventive medicine for enemy prisoners of war was practiced. These efforts are to be judged against the needs of U.S. troops who suffered at times from shortages of food, shelter, adequate footgear, and other necessities, while they were engaged almost constantly in combat (except for lulls during parts of two bitter winters) on what they called the forgotten front.

Activities and conditions in northern Italy.—In northern Italy, in May 1945, the breakthrough into the Po River Valley and the battle of pursuit to the Dolomite Alps resulted in the capture of multitudes of prisoners of war from two main sources. One was the overrun large German military hospitals; the other was the disintegrating combat units of the *Wehrmacht* whose personnel surrendered en masse. Paraphrasing accounts by the Office of the Surgeon, Fifth U.S. Army,³⁸ and Wiltse,³⁹ the situation may be described as a vast mixture of hospitalization for the medical care of German sick and wounded and of field preventive medicine for captured soldiers who it was desirable to maintain in as healthy a condition as possible.

Number and condition of prisoners of war.—"When a complete count was made, as of 15 June [1945], the U.S. share of the more than half million prisoners taken in Italy since Salerno was 299,124, of whom 147,227 were under Fifth Army control and 151,897 belonged to the Peninsular Base Section."⁴⁰

In the first weeks after the German surrender, most of the new prisoners were in poor condition nutritionally. It was not possible for the Fifth U.S. Army to remedy these deficiencies at once, but within a few weeks, supplies of rations became adequate. This was a notable achievement considering the complexities of the terminal fighting, the beginning of redeployment, and the reception and care of thousands of recovered Allied military personnel returning from German prison camps.

³⁸ (1) Report, Surgeon, MTOUSA, Headquarters Fifth Army, Office of the Surgeon, 4 Sept. 1945, subject: Fifth Army Medical Service, 1 January–31 August 1945. (2) Fifth Army Medical Service History, 1 January 1945–9 September 1945. See especially Ch. III, pp. 41–49, Prisoners of War, by Capt. Sidney Hyman, MAC, Medical Historian.

³⁹ Wiltse, Charles M.: *The Medical Department: Medical Service in the Mediterranean and Minor Theaters. United States Army in World War II. The Technical Services.* Washington: U.S. Government Printing Office, 1965.

⁴⁰ Wiltse, Charles M.: *The Medical Department: Medical Service in the Mediterranean and Minor Theaters. United States Army in World War II. The Technical Services.* Washington: U.S. Government Printing Office, 1965, p. 535.

Special Measures for Handling Prisoners of War

For supervision of the handling of enemy prisoners of war, particularly those derived from defeated or disbanded combat elements, two intelligent and effective measures were taken by the Fifth U.S. Army in May 1945, as follows:

1. *Assignment of combat troops.*—The 88th Infantry Division was assigned as the Mediterranean theater Prisoner of War Command. It assumed responsibility for guarding hospital areas and equipment, disciplinary action, and the myriad details involved in the handling of prisoners of war throughout northern Italy, according to comprehensive directives issued by Allied Force Headquarters and Fifth U.S. Army Headquarters. As the Prisoner of War Command, the 88th Infantry Division had its main headquarters at Modena and Ghedi (80,000 prisoners entered these enclosures during the week of 17–24 May 1945). The Prisoner of War Subcommand of the 88th Infantry Division supervised the Pisa-Leghorn system of enclosures.⁴¹

Assistance was given to the medical service by appropriate details from the 88th Infantry Division. During the first weeks after the surrender, prisoners entering the cages were mostly infested with lice. They were thoroughly dusted with DDT powder. Intense efforts were made to cleanup the cages at Ghedi, Modena, Piacenza, Verona, and at other locations. In 2 days, for example, 80 truckloads of manure, tin cans, and other refuse left by the fleeing Germans were carted away.⁴²

2. *Assignment of sanitation supervisor.*—An officer from the Surgeon's Office, Maj. Frank H. Connell, SnC, Assistant Medical Inspector, was assigned as supervisor of sanitation of prisoner-of-war cages throughout northern Italy. Later, Lt. Col. Harris S. Holmboe, MC, supervised all sanitary and medical matters at Ghedi. "Sanitation facilities at Ghedi rapidly improved during the summer, until by July [1945], under constant US supervision, they had reached as near US standards as the facilities available permitted. An adequate water supply for washing and cooking was available, latrine boxes were erected, pits were sprayed daily with diesel oil, messkit laundries were established at all messes, and bathing facilities were gradually built up to the acceptability required for the maintenance of a good state of health among so many concentrated personnel."⁴³

Repatriation of Prisoners of War

Repatriation of enemy prisoners of war was a major task, which, undertaken shortly after the German surrender on 2 May 1945, increased

⁴¹ History, 88th Infantry Division, 25 Aug. 1945.

⁴² A similar assignment of combat troops was made in the European Theater of Operations, U.S. Army, in April 1945, when the 106th Infantry Division, reinforced, was designated to assist the Theater Provost Marshal in handling the huge numbers of captives.

⁴³ See footnote 38 (2), p. 367.

in complexity and urgency as time passed. It involved not only transportation of sick and wounded, but also the movement of well soldiers in a manner that required application of principles of preventive medicine suitable to the transport of troops. The movement was chiefly through Ghedi, Merano, Bolzano, and the Brenner Pass into Austria and Germany. This constituted a transfer of individuals from Italy to an area controlled by Supreme Headquarters, Allied Expeditionary Force.

To resolve jurisdictional problems and to draw up schedules and priorities for adjustment of sick and wounded prisoners of war, Col. Alvin L. Gorby, MC, Surgeon, 12th Army Group, called a conference of medical officers at Wiesbaden, Germany, on 12 and 13 July 1945. About this time, Supreme Headquarters, Allied Expeditionary Force, was replaced by United States Forces, European Theater. Both British and American representatives were present at the meeting. Among the American representatives at the conference were Lt. Col. Albert A. Biederman, MC, Plans and Operations Officer, Medical Section, Mediterranean theater, and Col. John Boyd Coates, Jr., MC, and Lt. Col. Robert J. Goldson, MC, representing, respectively, the Third and the Seventh U.S. Armies. The representatives were concerned primarily with problems of the return of prisoners of war who were under medical jurisdiction. They desired to move these individuals to the vicinities of their homes, both in the U.S. Zone as well as in the British Zone of Germany. The American representatives wished to prevent saddling U.S. forces with the burden of caring for the thousands of sick and wounded German prisoners of war whose native homes were in the British Zone. A satisfactory program was worked out. The Fifth U.S. Army carried out its part so well that, by 1 September 1945, the job had been completed as far as the evacuation of former enemy patients from northern Italy was concerned.⁴⁴

Status of Surrendered Enemy Personnel

The question of the status of surrendered enemy military personnel came up for special consideration in the last stages of the Italian Campaign and its immediate aftermath. The question was (and is) whether the Geneva Convention of 1929 "Relative to the Treatment of Prisoners of War" was violated by the decision of the Allies to place surrendered enemy personnel in a special category which deprived the surrendered individual of the rights and privileges inherent in the status of prisoner of war, as defined by the convention. In the Medical Service History of the Fifth U.S. Army,⁴⁵ the difference between "prisoners of war" and "surrendered [enemy] personnel" was overlooked. They were treated alike—"all were afforded equal treatment, equal rations, and equal rights." On the other hand, the Assistant Chief of Staff for Intelligence, G-2, 88th Infantry

⁴⁴ From official records and personal communication, Col. John Boyd Coates, Jr., MC, to the author, 6 Sept. 1963.

⁴⁵ See footnote 38 (2), p. 367.

Division, which was then the Prisoner of War Command, recorded a contrary point of view. On 15 August 1945, he wrote, "Occasionally, this office received strongly worded communications from individuals who felt they were being treated unjustly and who quoted freely the Geneva Convention to back up their claims. These people evidently were not aware of the fact that all enemy personnel in Italy under this command are classified as 'Surrendered Enemy Forces' and since the German surrender was an unconditional one surrendered enemy forces have no rights under the Geneva Convention. In order to eliminate further instances, such as these, the German 'Guard House Lawyers' were reminded that their propounded rights as PW's would not be tolerated in the future."⁴⁶

This is not the place to discuss the difficult question: "Can the status of prisoners of war be altered?" It has been dealt with exhaustively by Wilhelm in a legal monograph for the International Committee of the Red Cross.⁴⁷ In his opinion, the rights of prisoners of war are inalienable; surrendered enemy personnel should have been regarded as prisoners of war. "Military necessity"—the inability of the Allies to care properly for the hundreds of thousands of German soldiers surrendered in the final debacle—might have been invoked as a better reason for depriving them of their status as prisoners of war.⁴⁸

Diseases Among Prisoners of War

The diarrheas and dysenteries were common among enemy prisoners of war in northern Italy from May to September 1945, but not so prevalent as they were among prisoners of war in Tunisia in 1943. With regard to other diseases among German troops in Italy during the period 1943-45, Colonel Long, Chief Consultant in Medicine, Mediterranean theater, made observations and collected information when he visited, in May and June 1945, the overrun German military hospitals in Merano, Bolzano, and Cortina d'Ampezzo and conferred with German medical officers. The following is an abstract of a portion of his report,⁴⁹ as follows:

⁴⁶ See footnote 41, p. 368.

⁴⁷ Wilhelm, René-Jean: *Peut-on modifier le statut des prisonniers de guerre?* Rev. internat. Croix-Rouge 35: 516-543, July; 681-690, September 1953.

⁴⁸ Experience in World War II indicated the need for a more detailed instrument than the Geneva Convention of 1929. One of the deficiencies was the imprecise definition of prisoners of war. This was remedied by the revised Geneva Prisoner of War Convention which was adopted on 12 August 1949, ratified by the U.S. Government on 14 July 1955, and entered into force in the United States of America on 2 February 1956 (Treaty Series, No. 3364). This treaty retains under the designation of prisoners of war all those included in the 1929 text and adds several other classes of persons who, when they fall into the power of the enemy, are entitled to be treated as prisoners of war. In addition, the 1949 convention specifies in detail a number of provisions which had not been so clearly stated in the 1929 convention. With regard to the apparent redundancy of the 1949 text, Maj. Gen. Joseph Vincent Dillon has pointed out, quoting a statement attributed to a Lord Chief Justice of England in the 18th century with respect to Common Law Pleading, "that it is better to err on the side of pleonasm than on that of exiguity." This point of view influenced the drafters of the 1949 convention. They sought "to expressly cover as much as possible and leave as little as possible to imagination or discretion." (See footnote 6 (1), p. 343.)—S. B.-J.

⁴⁹ Long, Perrin H.: *Mediterranean (Formerly North African) Theater of Operations. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants.* Washington: U.S. Government Printing Office, 1961, pp. 203-208.

- a. Field or war nephritis, present among German but not among American troops.
- b. Infectious hepatitis.
- c. Trench fever (Volhynia fever). "There were hundreds of cases of this louseborne disease among [German] troops in the Mediterranean area in the winters of 1943-44, 1944-45. It reached epidemic proportions in German troops in Russia."
- d. Atypical primary pneumonia—probably several diseases in addition to the usual virus pneumonia; referred to as the Grecian disease or Balkan gripe, as it was prevalent among German troops in Greece. (In 1945, "Balkan gripe" was shown by the Commission on Acute Respiratory Diseases of the Army Epidemiological Board to be Q fever, caused by *Rickettsia burneti*.)
- e. Trenchfoot—notable by its absence from German troops even during the winter campaigns in Italy. "As the Germans said, a word for this condition does not exist in the German language." Plenty of true frostbite was seen in the Russian Campaign but all German medical officers stated that they had not seen "Trench Foot" in German soldiers in MTOUSA during the winter of 1943-44 and 1944-45. In fact some of them said that they had traveled many miles to observe American prisoners of war who suffered from "Trench Foot." They attributed this absence of "Trench Foot" to:
 - (1) Excellent foot hygiene and discipline.
 - (2) The easily removable high leather German field boot.
 - (3) The four pairs of thick but loosely woven all-wool high stockings provided to forward troops in winter.
- f. Peptic ulcer.
- g. Diphtheria—increased incidence during the past year, 1944-45, with a fair amount of diphtheritic paralysis following the acute disease.
- h. Amebic disease (dysentery).
- i. Streptococcal infections.
- j. Typhoid and paratyphoid fevers.
- k. Nutritional deficiencies.

Evaluation

In his summary of the just cited report, years later, Colonel Long wrote:

In summary, it may be said that * * * the consultant in medicine frequently encountered serious problems in carrying out the duties specifically given to him by a verbal order of Maj. Gen. Everett Hughes, Deputy Theater Commander, NATOUSA.

General Hughes had stated unequivocally, "I want prison camps, both disciplinary and POW, run in a strict but humane fashion." At times, the level of care in prisoner-of-war camps was excellent and in full accord with these orders. At other times, it was considerably less good, chiefly because of thoughtless administrative practices in lower echelons. The solution of the problem was strict adherence to the Geneva Convention dealing with the treatment of prisoners of war, and the consultant in medicine * * * made it his business to see that those in charge of these men fully understood their responsibilities toward them.

Proud of its accomplishments, particularly those of the final 4 months of operations, the medical service of the Fifth U.S. Army ended its prisoner-of-war history with this cheerful note:⁵⁰

What had promised on 2 May [1945] to be an almost overwhelming burden for the Army Medical Service, * * * by 9 September, when Fifth Army became inoperational,

⁵⁰ See footnote 38 (2), p. 367.

[had] been completely resolved. Hospitalization and evacuation of the German military in Italy had been successfully accomplished. The health of the German Army was actually far better than in the days before the surrender.

EUROPEAN THEATER OF OPERATIONS⁵¹

Within 336 days, the Allied Expeditionary Force entered the continent of Europe, occupied the heartland of Germany (map 7), and destroyed her armed forces, fulfilling the mission which the Combined Chiefs of Staff had communicated to General Eisenhower as Supreme Commander of "the mightiest force which the two western Allies could muster."⁵²

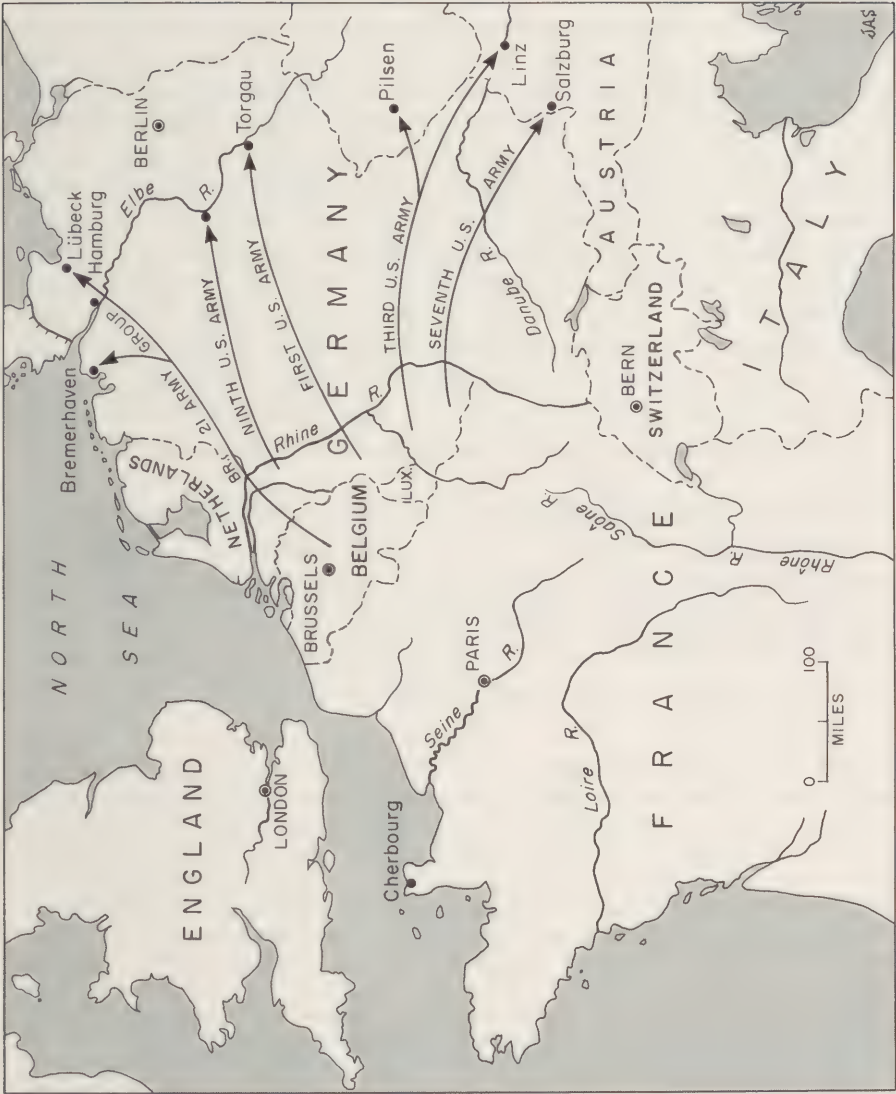
Operation OVERLORD

From 6 June 1944, D-day, when the landings on the Normandy beaches were begun, to 8 May 1945, V-E Day, when Germany surrendered, this host had crossed the English Channel, had advanced through the length and breadth of northwest Europe, had crossed the Rhine River, and had proceeded to regions near the Elbe and Danube Rivers (map 7). This tremendous accomplishment, phenomenally achieved in less than a year, was crowded with unexpected and almost inconceivable events. Among these, the capture of vast masses of enemy prisoners of war, tantamount to the major portion of the residual German Army, constituted a spectacular feature of the continental envelopment. As a consequence, the handling and treatment of those thousands of prisoners became an onerous responsibility and brought to the fore a multitude of problems, both old and new, complicated by the exigencies of total war.

In the first portion of this chapter, a program of preventive medicine for enemy prisoners of war has been presented. The account of activities along the same lines in the North African and Mediterranean theaters included descriptions and discussions of the problems that arose in many situations during the campaigns in those theaters. In fundamentals and episodes, the administrative, medical, and sanitary events in the handling of prisoners of war were typical of occurrences in the same fields of preventive medicine as in other theaters. They were so similar, in general, that names, places, and dates could be interchanged without serious distortion of the realities. In view of these similarities, the account of events

⁵¹ The European Theater of Operations, U.S. Army, was redesignated United States Forces, European Theater, on 1 July 1945. Supreme Headquarters, Allied Expeditionary Force was officially activated on 13 February 1944. After its establishment, the U.S. component at Supreme Headquarters tended to assume the functions of a theater headquarters, while the European theater at the same time became increasingly a communications-zone organization only. The mission of the European theater after V-E Day became primarily one of redeployment.

⁵² (1) Eisenhower, Dwight D.: Report by the Supreme Commander to the Combined Chiefs of Staff on the Operations in Europe of the Allied Expeditionary Force, 6 June 1944 to 8 May 1945, dated 13 July 1945. Washington: U.S. Government Printing Office, 1946. See especially pp. vi-vii. (2) Harrison, Gordon A.: Cross-Channel Attack. United States Army in World War II. The European Theater of Operations. Washington: U.S. Government Printing Office, 1951, pp. 457-458. (3) Eisenhower, Dwight D.: Crusade in Europe. Garden City, New York: Doubleday & Co., Inc., 1949, p. 225.



MAP 7.—Advance of the British 21 Army Group and the Ninth, First, Third, and Seventh U.S. Armies from the west bank of the Rhine River to the Elbe and Danube Rivers, 15 March to 8 May 1945.

that happened in the European theater can be shortened, and a monotonous and distressing repetition of a catalog of miseries can be somewhat avoided.

Plans and Directives

To gather information for use in planning Operation OVERLORD (the invasion of Europe), officers of headquarters in London visited North Africa and Italy in 1943 and 1944 to look into the handling of enemy prisoners of war. In addition, surgeons and provost marshals of the First and Third U.S. Armies held conferences at several headquarters on how best to handle prisoners of war and made estimates, which turned out to be underestimates, of the numbers likely to be captured monthly during 1944. Apparently, no new lessons were learned, particularly with reference to problems imposed by mass-captures, although the inadequate enclosures at the Mediterranean base sections and the overcrowded, dismaying compound at Mateur were there to be seen. This preinvasion planning and its unimaginative forecast of needs were summarized in a report from the Third U.S. Army: "Inasmuch as the material available concerning Prisoners of War was negligible, excellent use was made of Field Manual 27-10, Rules of Land Warfare, and reports from the African, Sicilian and Italian Campaigns."⁵³

As this lack of directives indicates, the Geneva Conventions of 1929 and the *Rules of Land Warfare* were the main sources of material that was incorporated in standing operating procedures, circulars, and orders. The best overall example is Standing Operating Procedure No. 16⁵⁴ issued first in June 1944 by Headquarters, European theater, for the governance of the theater. From this regulation, paragraph 1b is quoted in part, as follows:

Basis of Responsibility for Prisoners of War. The overall responsibility with regard to prisoners of war is based on the undertakings of the US government pursuant to the provisions of the Geneva Convention of 27 Jul 1929 and the Red Cross Convention of the same date. Commanders of combat units and other units responsible for the handling of prisoners of war will insure that all personnel have a thorough knowledge of the principles to be observed in relation to prisoners of war, as set forth in FM 27-10, "Rules of Land Warfare." Emphasis will be placed on the provisions of the Geneva Convention relative to the treatment of prisoners of war. Attention will be especially

⁵³ (1) After Action Report, Third U.S. Army, 1 August 1944-9 May 1945. Vol. II, Staff Section Reports; Part 19, Provost Marshal, pp. PM 1-31 and annexes PM I-XVIII. (2) In commenting on this paragraph, one of the reviewers, who was Deputy Provost Marshal, Advance Section, Communications Zone, European Theater of Operations, U.S. Army, stated that the Third U.S. Army made radical departures from the established policies and procedures of evacuation of enemy prisoners of war.—S. B.-J.

⁵⁴ (1) Headquarters, European Theater of Operations, U.S. Army, Standing Operating Procedure No. 16, Evacuation, Processing and Handling of Prisoners of War, issued 21 June 1944, superseded 3 Dec. 1944. (2) It is to be noted that Standing Operating Procedure No. 16 was not issued until 15 days after the invasion of Europe had started. It did not reach provost marshals "until months after the operation started. Advance Section was attached to First Army for the initial phase of the operation and ADSEC followed First Army SOP." (Personal communication from Col. Valentine M. Barnes, Jr., MPC, to the author.—S. B.-J.)

directed to the fact that the rights of prisoners of war, as set forth by treaty, * * * are binding on all US troops in the same manner as are the Constitution and laws of the United States.

From time to time, the First, Third, and Ninth U.S. Armies, Headquarters, Advance Section, Communications Zone, and Headquarters, 12th Army Group, issued similar statements coupled with detailed instructions for sanitary arrangements and supervision of prisoner-of-war enclosures and camps. On the whole, these were motivated by good intentions and were sound in principle. On review, however, in the light of events, they seem to lack an appreciation of the ghastly realities of the situations and were a bit naive. For example, they repeated often such an impossible requirement as that prisoners should have access, night and day, to toilet facilities (latrines and so forth) equal in equipment and sanitary maintenance to those that were standard for U.S. troops. The absurdity of this requirement will become more obvious when conditions in enclosures like the one at Remagen during March and April 1945 are described, where the dysenteric feces of the penned-in thousands were trampled and emulsified in the muddy surface of the ground.

Collection and Evacuation of Enemy Prisoners of War

The system of collecting points, routes of evacuation, and enclosures for enemy prisoners of war, as shown in chart 6 (p. 353), was adhered to as closely as circumstances permitted during the advance to the Rhine. After that barrier was breached in March 1945, and the avalanche of prisoners began to pour through the river crossings, modifications had to be made, as will be described later.

Planned capacity of Central Prisoner of War Enclosures in France.—

Even at the beginning, Central Prisoner of War Enclosures were too few, too small, and understaffed. This led to overcrowding (fig. 34) and impeded the application of preventive medicine measures as well as the processing and handling of prisoners. The following report and comments give information about the deficient planning and its consequences.

Theater planning for the handling of enemy prisoners of war was rather unrealistic. It left much to be desired and apparently ignored the difficulty experienced in North Africa in handling a large influx of POW's. This cannot be completely laid to inadequacies in the Theater Provost Marshal's Office which was planning within the restrictions imposed by the overall concept of the operation. For instance, the planners asked for 49 Military Police Escort Guard Companies; only 19 were authorized by the War Department. As there was no T/O&E for a Prisoner of War Camp Overhead Detachment, the Theater Provost Marshal planned a provisional one and got authority to activate eight of them, one for a POW camp in England and seven for use in France. Each of these POW Camp Overhead Detachments was estimated by the planners to be able to handle 6,000 POW's. Thus the planning was geared to accommodate at any one time a total of 48,000 POW's in the eight camps. The capture rate for the first 90 days was estimated at 1,000 a day. This would require that about one-half of the number captured during the first 90 days would have to be shipped out of the theater.



FIGURE 34.—Approximately 10,000 German prisoners of war waiting to be fed at an enclosure near Nonat Le Pin, France, 21 August 1944. (U.S. Army photograph.)

The ETOUSA plan up to the time of the beginning of the operation consisted of provision for the following enclosures:

Burton on the Hill, England

1,000-man Evacuation Enclosure, Omaha Beach, D+20

1,000-man Evacuation Enclosure, Cherbourg, D+20

1,000-man Evacuation Enclosure, Saint-Lô, D+20

2,000-man Evacuation Enclosure, Rennes, D+30

1,000-man Evacuation Enclosure, Saint Malo, D+40

1,000-man Labor Enclosure, Rennes, D+75

6,000-man POW Enclosure, Saint Nazaire, D+90

Insofar as ADSEC was concerned, only one small enclosure was constructed in France, at Cherbourg. ADSEC thereafter took over the small (3,000 maximum capacity) enclosures constructed by First and Third U.S. Army engineers as these units fought forward or found other places suitable for use as POW enclosures. Such places were the partially completed casern at Namur, in Belgium, and the badly damaged old French post at Stenay. The ADSEC Provost Marshal got places of this type after it was determined that no one else wanted them. An old French post was taken over at Suippes, in France. After it had been fenced and repaired to some extent by POW's, the XVIII Airborne Corps wanted it and the POW's had to be moved.

None of the enclosures taken over from the Armies was suitable for expansion, and they were not well located. Each was quickly closed. Search was made for fenced areas with buildings or prisons for use as POW enclosures. Some such places were

available in France, but no advance knowledge about them was at hand, and they were never noted to be a part of any theater plan for POW use.

In fact, the POW situation "just grew like Topsy" and places that normally would not house more than 5,000 or 6,000 persons were rated as 30,000-man camps, primarily because that was the number crowded in. If there was any comprehensive theater plan it was "after the fact" and not before. After it was all over, however, and had to be written up, there suddenly developed a plan. In effect, ADSEC was the tail that wagged the dog, for places in which POW's were put originally were usually retained as POW camps.⁵⁵

In addition to division, corps, and Army collecting points, about 21 Central Prisoner of War Enclosures and a number of subcamps were established during 1944 on the continent of Europe, in Advance Section, Communications Zone, and in the Communications Zone base sections (Normandy, Brittany, Oise, Loire). Of these, the enclosures at Namur, Belgium, and Stenay, France, in the Advance Section (1944 and early 1945), were the busiest receiving, holding, and transfer points. A typical scene in a collecting point enclosure is shown in figure 35.

There were two large enclosures in the Southern Line of Communication, the more important of which was in the area of the port of Marseille on the route of evacuation to the continental United States. Although it is impossible to be sure of the figures, the total capacity of the prisoner-of-war enclosures in Advance Section, Communications Zone, and in the base sections in France, in late 1944 and early 1945, may be taken to have been about 330,000 with distributions of 10,000 to 40,000 in the various camps.⁵⁶ In addition, as of midnight 31 January 1945, 342,371 prisoners of war were being held in the Southern Line of Communication.⁵⁷

Incidents in the evacuation of enemy prisoners of war.—As the military police and other units under the jurisdiction of the provost marshals were primarily responsible for the holding and evacuation of prisoners of war, their reports are full of accounts of events and discussions of problems involving preventive medicine.⁵⁸

Although more details about prisoner-of-war enclosures will be supplied in the next section (pp. 380–384), a few examples of the unsatisfactory, and occasionally fatal, conditions along the lines of evacuation will be mentioned here. Food, drinking water, and latrine cans were insufficient on some of the rail shipments. Often, prisoners of war were transported long distances in open gondola freight cars or in open trucks ingeniously packed with men (fig. 36).

⁵⁵ Personal communication, 16 July 1963, Col. Valentine M. Barnes, Jr., MPC, former Deputy Provost Marshal, Advance Section, Communications Zone, European Theater of Operations, U.S. Army, to the author.—S. B.-J.

⁵⁶ History of the Office of the Theater Provost Marshal, ETOUSA, 1 Oct. 1944–8 May 1945, sec. VII, History, Prisoner of War Division. [Official record.]

⁵⁷ Memorandum for Record, Planning Branch, Operations Division, Office of the Chief Surgeon, Headquarters, ETOUSA, 10 Feb. 1945, subject: Prisoners of War Held by US Forces in ETO.

⁵⁸ Extracts From Military Police Operational Reports, World War II. Military Police School, Camp Gordon, Ga., vol. I, July 1950.



FIGURE 35.—Collecting point for German prisoners of war at Beaugency, France, 19 September 1944. These are some of the 20,000 Germans who surrendered and awaited transport farther to the rear. (U.S. Army photograph.)

Two tragic episodes occurred in the shipments of prisoners of war from Stenay and Namur to Mailly-le-Camp, on 16 March 1945, in overcrowded, closed "40 and 8" boxcars that had been renovated by lining them with plywood, leaving no openings for ventilation. On arrival, 127 of the prisoners were found dead from suffocation. These two incidents occurred while the prisoners were being escorted and guarded by combat troops borrowed for the purpose from the 16th Armored Division, then waiting in a staging area for the arrival of its equipment. These troops were inexperienced in handling prisoners of war. They had received briefing in their guard and escort duty from experienced personnel, but they did not understand German. Therefore, they did not realize that the commotion being raised by the prisoners in the boxcars was for air. The Deputy Provost Marshal concerned in this case believed that, if the escort guards had been experienced military police personnel, this unfortunate incident probably would not have occurred. At this time, the flow of prisoners was so great that combat troops had to be "borrowed" to assist in handling them. One hundred escort and guard teams were borrowed, each consisting of 29 enlisted men and 1 officer. These teams each escorted trainloads of from 1,500 to 1,600 prisoners of war.

To prevent recurrences of defective handling of prisoners of war,



FIGURE 36.—Evacuation of enemy prisoners of war to the rear in crowded open trucks. German soldiers captured by the 99th Infantry Division, First U.S. Army, board trucks at Sundwig, Germany, 16 April 1945. (U.S. Army photograph.)

special correctional directives were issued by Headquarters, European theater.⁵⁹

Review by the General Board.—After the end of the war, in the latter half of 1945, a General Board of United States Forces, European Theater, reviewed the military police activities in connection with the evacuation of prisoners of war. The report of this board⁶⁰ is comprehensive, and contains valuable recommendations. It is, however, essentially an administrative and logistical document. The severe and unsatisfactory medical and sanitary conditions (fig. 37) of the evacuation operations are indicated in it, but not dealt with in detail, since, having no special medical organization for the care of enemy prisoners of war, the military police had to depend upon the theater medical and sanitary services, which in a sense were adventitious. The board concluded “that the procedure for the handling and evacuation of prisoners of war as set forth in Field Manuals 19–5, 29–5, and 100–10, as modified by European Theater of Operations Standing Operating Procedure Number 16, dated 3 December 1944 and 12th Army Group Administrative Standing Operating Procedure, dated

⁵⁹ (Directive) Hq., ETOUSA, 26 Mar. 1945, subject: Movement of Prisoners of War. See also: Book message, Hq., ETOUSA, 25 Mar. 1945, same subject, to Base Sections, ADSEC COMZ, CONAD, etc., signed Lee.

⁶⁰ Report, The General Board, United States Forces, European Theater, The Military Police Activities in Connection With the Evacuation and Detention of Prisoners of War, Civilian Internees, and Military Personnel Recovered From the Enemy, Provost Marshal Section, Study No. 103, 1945.



FIGURE 37.—Part of an estimated group of 82,000 German soldiers captured in the Ruhr pocket cleanup by the XVIII Airborne Corps, near Gummersbach, Germany, 17 April 1945. (U.S. Army photograph.)

18 October 1944, was followed whenever practicable, and that there were many variations from this procedure.”

Prisoner-of-War Transient Enclosures on the Rhine

By early 1945, all prisoner-of-war central enclosures in Belgium and France were overcrowded. They would not be able to receive and contain the droves of German prisoners that would be captured from the middle of March onward by the First, Third, and Ninth U.S. Armies, after the Rhine was crossed. To provide for temporary holding of approximately $1\frac{1}{2}$ million of these anticipated captives, 17 Prisoner of War Transient Enclosures were hurriedly constructed by Advance Section, Communications Zone, in April and May 1945. They were mostly fenced pasture land. The planned capacities ranged from 25,000 to 100,000. Prisoners of war evacuated from the field armies advancing into Germany and Austria crossed the Rhine River over a railroad bridge near Wesel in the north, a pontoon bridge near Remagen in the center, and another railroad bridge



FIGURE 38.—At a prisoner-of-war enclosure near Remagen, Germany, a U.S. soldier takes part in keeping guard over thousands of German soldiers captured in the Ruhr area, 25 April 1945. (U.S. Army photograph.)

near Mainz in the south. The transient enclosures were constructed on the west side of the Rhine in the vicinities of these river crossings. At this time, no rails crossed the Rhine and if the new enclosures were constructed on the east side, it would be too large a trucking job to supply them from railheads on the west side (fig. 38).

In the first phase of construction, which was rather prolonged, these enclosures consisted of only barbed wire fences in fields. Later, some canvas was provided, and still later, some buildings were put up. For most of the time, prisoners were without cover and were exposed to rain and snow and mud in the ending winter, and to heat, dust, or rain and mud as spring advanced to early summer. Some of the enclosures resembled Andersonville Prison in 1864, as suggested by the scene shown in figure 39, depicting a portion of the Prisoner of War Transient Enclosure at Sinzig, Germany, on 12 May 1945.

Assistance from medical groups.—The transient enclosures were served by Advance Section, Communications Zone, medical and sanitary organizations in their areas and administered by the 106th Infantry Division.⁶¹

⁶¹ Annual Report, Surgeon, 106th Infantry Division, 1 Jan.-17 Sept. 1945, dated 18 Sept. 1945.



FIGURE 39.—Prisoner of War Transient Enclosure at Sinzig, Germany, 12 May 1945. On that date, 116,000 German prisoners of war were held there, the rated capacity was 100,000. These prisoners are in a barbed wire fenced open field with little or no shelter. (U.S. Army photograph.)

In addition, medical groups ⁶² serving the field armies in the forward areas were supplementary sanitary agencies. The 65th, 66th, 67th, 68th, and 69th Medical Groups, late in 1944 and during the first half of 1945, greatly assisted the medical and provost marshal units of the First, Third, and Ninth U.S. Armies in the handling of prisoners of war at Army enclosures and in combat regions in which derogating circumstances due to military operations prevented the full application of the sanitary requirements of the Geneva Convention. Indeed, these requirements could not be met on the line of evacuation until the prisoners of war had entered the better types of camps or enclosures. In many cases, overcrowding, shortages of sanitary personnel, and lack of supplies, equipment, and facilities prevented the practice of preventive medicine.⁶³

Overcrowding.—Even the Prisoner of War Transient Enclosures became overcrowded. For example, the enlarged enclosure near Remagen,

⁶² (1) See footnote 16, p. 351. (2) Annual reports for the years 1944 and 1945 (various periods and dates) of the 65th, 66th, 67th, 68th, and 69th Headquarters and Headquarters Detachment, Medical Groups.

⁶³ Memorandum, Headquarters, Advance Section, Communications Zone, 24 May 1945, subject: Administrative Instructions for Prisoner of War Enclosures.

intended for 100,000 men was packed with 184,000. When the flow of prisoners from Army enclosures ceased, in May 1945, 1,611,979 prisoners of war had been evacuated from the Armies by Advance Section, Communications Zone.

Location of transient enclosures.—The designations, locations, and rated capacities of Prisoner of War Transient Enclosures, which were constructed in the region of the west bank of the Rhine in Germany from March to May 1945, are given in numerous documents. Most accessible is a vivid and informative article by Col. James B. Mason, MC, and Col. Charles H. Beasley, MC (respectively Deputy Surgeon and Surgeon, Advance Section, Communications Zone).⁶⁴ In these transient enclosures, medical and sanitary conditions were similar to those already described, but were more primitive and intensified.⁶⁵

The locations and authorized capacities of the Prisoner of War Transient Enclosures along the western side of the Rhine in Germany are shown in table 21 and map 8.

TABLE 21.—*Number, location, and authorized prisoner-of-war capacity of the 17 Prisoner of War Transient Enclosures along the western side of the Rhine River, Germany, May 1945*

Number	Location	Capacity
A1	Rheinburg	100,000
A2	Remagen	100,000
A3	Bad Kreuznach	45,000
A4	Büderich	55,000
A5	Sinzig	100,000
A6	Winzenheim	100,000
A7	Biebelsheim	100,000
A8	Dietersheim	100,000
A9	Wickrathberg	100,000
A10	Koblenz	50,000
A11	Andernach	45,000
A12	Heidesheim	30,000
A13	Urmitz	75,000
A14	Plaidt	10,000
A15	Planig	25,000
A16	Zahlbach	10,000
A17	Hechtsheim	50,000
Total		1,095,000

Source: Mason, James B., and Beasley, Charles H.: *Medical Arrangements for Prisoners of War En Masse*. Mil. Surgeon 107: 341-443, December, 1950.

⁶⁴ Mason, James B., and Beasley, Charles H.: *Medical Arrangements for Prisoners of War En Masse*. Mil. Surgeon 107: 431-443, December 1950.

⁶⁵ Semiannual Report, Office of the Surgeon, Headquarters, Advance Section, Communications Zone, European Theater of Operations, U.S. Army, 1 Jan.-30 June 1945.



MAP 8.—Location of the 17 Prisoner of War Transient Enclosures in the region of the west bank of the Rhine River, Germany, May 1945.

German Prisoner-of-War Statistics

General mention has been made of the large numbers of enemy prisoners of war captured by U.S. forces in the European theater. The bearing of these masses upon preventive medicine activities has been emphatically indicated. It is desirable now to examine some of the figures. During 1944, when the troubles were blamed more on deficient pre-invasion planning than on mere numbers of prisoners, the groups were fairly manageable. But after the Rhine had been crossed, early in 1945, the numbers of captives became almost overwhelming. A glance at the gross statistics, presented in table 22 and chart 7, is almost enough to disclose the entire story.

TABLE 22.—*German prisoners of war captured by U.S. forces, European Theater of Operations, U.S. Army, by months, June 1944–June 1945*

Month	First U.S. Army ^{1 2}	Third U.S. Army ³	Ninth U.S. Army ⁴	Fifteenth U.S. Army ¹	Other units and hospitals ¹	Total
<i>1944</i>						
June.....						⁵ 11,053
July.....	9,248				15	9,263
August.....	31,201	63,369			1,352	95,922
September.....	57,207	25,571	51,378		1,044	135,200
October.....	13,242	3,915	624		568	18,349
November.....	6,037	24,133	7,386		472	38,028
December.....	11,258	17,079	1,678		658	30,673
<i>1945</i>						
January.....	12,684	15,008	476		540	28,708
February.....	5,078	23,106	6,773		619	35,576
March.....	54,223	136,926	28,530		815	220,494
April.....	388,948	236,724	323,871	6,291	887	956,721
May.....	169,414	⁶ 90,698	703,079	3,846	27,582	994,619
June.....				484	53,483	53,967
Total.....	758,540	636,529	1,123,795	10,621	88,035	2,628,573

¹ Data for July 1944–January 1945 are from Operations History of the Advance Section, Communications Zone, ETOUSA, Covering the period from initial organization, October 1943 to inactivation 10 July 1945, app. E, p. 5, Prisoners of War Received by Months for the Operation 4 July 1944 to 30 June 1945. [Official record.]

² Data for February–May 1945 are from First U.S. Army, Reports of Operations, 20 October 1943–1 August 1944; 1 August 1944–22 February 1945; and 23 February–8 May 1945, Provost Marshal Annexes. [Official record.]

³ After Action Report, Third U.S. Army, 1 August 1944–9 May 1945. Vol. II, Staff Section Reports; Part 19, Provost Marshal, annexes PM V–XIX. [Official record.]

⁴ Conquer. The Story of Ninth Army, 1944–1945. Washington: Infantry Journal Press, 1947, p. 376.

⁵ Harrison, Gordon A.: Cross-Channel Attack. United States Army in World War II. The European Theater of Operations. Washington: U.S. Government Printing Office, 1951, *passim*.

⁶ First 8 days.

From table 22 and chart 7, it is seen at once that the major captures, totaling 2,132,413 prisoners of war, were made by the First, Third, and Ninth U.S. Armies during March, April, and May 1945. These captures occurred during the swift campaigns identified, as follows:

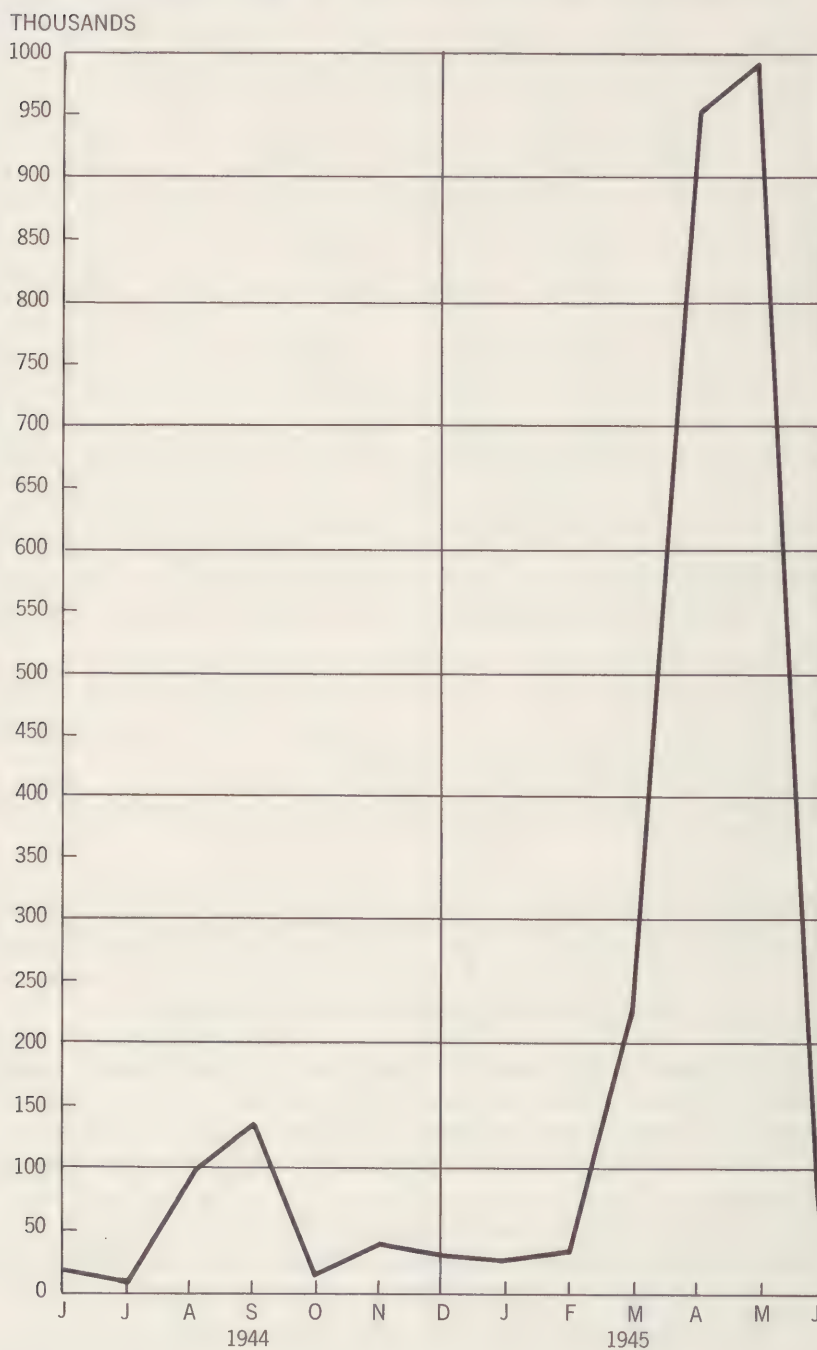
First U.S. Army, from the Rhine to the Elbe; from Bonn to Torgau, including the double envelopment of the Ruhr in April: March (54,223), April (388,948), May (169,414). Total: 612,585.

Third U.S. Army, from the Rhine to the Danube; from Mainz, Germany, to Linz, Austria: March (136,926), April (236,724), May (90,698). Total: 464,348.

Ninth U.S. Army, from the Rhine to the Elbe; from Wesel to Mädeberg, including the double envelopment of the Ruhr in April: March (28,530), April (323,871), May (703,079). Total: 1,055,480.

A word should be said about the variance of the statistics of enemy prisoners of war captured in the European theater. Reports of the First,

CHART 7.—*German prisoners of war captured by U.S. forces, European Theater of Operations, U.S. Army, by months, June 1944 to June 1945*



Third, and Ninth U.S. Armies differ from those of the 12th Army Group,⁶⁶ of which they were the main components, while the statistics reported by Advance Section, Communications Zone, furnished by the Theater Provost Marshal, differ in detail and totals from the others. Even within an Army, the figures vary. For example, the Provost Marshal of the Third U.S. Army⁶⁷ reported that the total number of prisoners of war captured in the period from August 1944 to May 1945 was 636,529, the Theater Provost Marshal⁶⁸ reported 546,947, while in his General Orders No. 98, dated 9 May 1945, entitled "Soldiers of the Third Army, Past and Present," General Patton stated, "Prior to the termination of active hostilities, you had captured in battle 956,000 enemy soldiers * * *." Although the author spent much time examining various records in the attempts to reconcile these and other discrepancies, and although several explanations were furnished personally by former provost marshals, he was not able to discover all the reasons for the disparities. He came to the conclusion that corrected figures do not exist and that adjustments cannot be made from the available records. He concluded further that, for the purposes of this chapter, the magnitudes, which were real and confirmed by all eyewitnesses, are all that matter. Little would be gained for the comprehension of the medical and sanitary problems of such multitudes of prisoners of war by refinement of statistics to the point of numerical accuracy.

Sanitary and Preventive Medicine Problems Consequent Upon Mass Captures

The inferences to be drawn regarding the problems of preventive medicine for enemy prisoners in the European theater are obvious. Their factual occurrence are matters of record, particularly in the writings of several preventive medicine officers, notably Col. John E. Gordon, MC,⁶⁹ Chief of the Division of Preventive Medicine, Office of the Chief Surgeon, European theater. Writing about the great difficulties that came with the last 3 months of the war, Colonel Gordon stated:

* * * The debacle overwhelmed many services of the Army * * *. German soldiers surrendered by armies; hundreds of thousands within days. The facilities provided for receiving prisoners of war were wholly insufficient. * * * The enclosures for prisoners of war met their name. They were cages and little more. So great were the numbers that scarcely more than a pretext of proper care could be provided. Water supplies were alright as far as they went, but the amount of water available per man was hopelessly small. Messing equipment did not begin to go around and thousands ate out of tin cans discarded from the ration. Facilities for sterilizing kitchen equipment and mess

⁶⁶ Report of Operations (Final After Action Report), 12th Army Group, vol. X, sec. V, pp. 212-250.

⁶⁷ See footnote 53 (1), p. 374.

⁶⁸ Operations History of the Advance Section, Communications Zone, ETOUSA, covering the period from initial organization, October 1943, to inactivation, 10 July 1945, app. E, p. 5, Prisoners of War Received by Months for the Operation 4 July 1944 to 30 June 1945. [Official record.]

⁶⁹ Gordon, John E.: A History of Preventive Medicine in the European Theater of Operations, U.S. Army, 1941-45, vol. I, pt. III, sec. 2, No. 1, pp. 18-19. [Official record.]

gear were greatly overtaxed. Some cages were so crowded that the men scarcely had room to lie down and they slept in pup tents, improvised shelters, fox holes or in the open. The approaching warm weather led to an increase in flies, but never to the extent that would have existed without * * * DDT spray. The situation was further aggravated in [some] areas * * * by a series of unprecedented rains which turned the enclosures into a morass and the prisoners into shivering wretches. Dysentery was inevitable.

Water supplies.—Water supplies for the enclosures were obtained from wells, streams, and rivers. These were in better condition and the water was more thoroughly treated at the older enclosures than at the newer transient enclosures. At the transient enclosures, all water for drinking had to be heavily chlorinated, and this was done in Lyster bags when possible. It was not possible always to furnish completely treated water and chlorinated river water was frequently piped into the enclosures along the Rhine. At some enclosures (Remagen, for example), gasoline tank trucks, after some washing out, were filled with Rhine water and then driven around the barbed wire boundary of the camp, hour after hour, 18 hours a day, to fill barrels and drums from which the prisoners dipped water for drinking, for washing messkits, and for the care of bodily cleanliness, as specified by the Geneva Convention, which meant douching of the perineum after defecation. It was recorded that this part of the toilet was done by hand, usually, and that the contaminated hand was then rinsed in a barrel of water intended for drinking. Thus, waterborne enteric infection was promoted by the militarily created situation. Later, of course, when a quieter stage was reached, this abuse of sanitary rules was eliminated.

Disposal of urine and feces.—Within the enclosure, U.S. sanitary and medical officers supervised the construction, by German protected personnel, of various types of soakage pits and latrines for the disposal of urine and feces. In Advance Section, Communications Zone, these efforts were often frustrated. They were more successful in the more stable enclosures in base sections. In the crowded forward enclosures, thousands of prisoners of war afflicted with diarrhea and dysentery defecated on the ground profusely and randomly. Their deposits could not have been covered even if they had been provided with paddles and drilled in the Mosaic code of camp sanitation. Slit trenches were dug, but apparently many German prisoners did not understand the orientation required for their proper use. Instead of straddling a trench and depositing feces in the trough, they squatted on one edge and ejected bowel contents upon the opposite bank. All of this added to contamination of soil, utensils, persons, and food.

Similar deficiencies of sanitation occurred on vehicles used to transport prisoners of war along the lines of evacuation.

With reference to sanitation during evacuation of prisoners of war in the early months of the campaign, a decision that the Theater Provost Marshal was forced by circumstances to make may have had an inhibitory

effect. In July 1944, the Assistant Chief of Staff for Logistics, G-4, Advance Section, Communications Zone, received an opinion from the Provost Marshal that "prisoners retained [on the continent for labor] were entitled to certain privileges under the Geneva Convention which might be disregarded while prisoners were in evacuation channels."⁷⁰ Evidence indicates that this was not an arbitrary decision by the Provost Marshal, Advance Section, Communications Zone. He was forced to render this decision by the unexpected and urgent demands for speedily making available German prisoners of war for the performance of labor, such as burial of the dead. At this time, provisions (personnel and facilities) for processing prisoners were lacking, and also, while they were in evacuation channels, they could not be housed, bathed, clothed, fed, or otherwise attended to as well as in established camps. As soon as possible, this state of affairs was corrected by Headquarters, European theater, and constant attempts were made to apply the terms of the Geneva Convention from the moment of capture.

Nutrition

The maintenance of an adequate state of nutrition is an important element of a military preventive medicine program, whether it is to be applied to a belligerent's own troops or to a belligerent's captives. This fact was appreciated by the Offices of The Surgeon General and The Quartermaster General in Washington, and by the staffs of the Medical Department and the Quartermaster Corps in the European theater during the campaigns of 1944-45. It was well understood also that, in accordance with the terms of the Geneva Convention, the food rations for enemy prisoners of war should be equal in quantity and quality to those furnished U.S. troops at base camps.

Although these requirements were recognized, their fulfillment varied from adequate in 1944 to marginal and deficient in 1945 with a gradual improvement after July of that year. The deficiencies arose from a number of causes which have been mentioned in preceding parts of this chapter. In the period from March to the end of July 1945, the decrements were caused by (1) lack of planning for feeding the unexpectedly large numbers of rapidly captured prisoners of war, (2) the continuance of issue based upon troop strength, although there were many extra thousands to be fed—prisoners of war, recovered Allied military personnel, and displaced persons, (3) food shortages in the United States and in the United Kingdom in 1945, which required reduction of food supplies for prisoners of war, (4) lack of mess gear and cooking equipment for prisoners of war—a secondary but important deficiency, since ability to serve food is second only to ability to supply food, and (5) inter-Allied dissatisfactions over

⁷⁰ Operations History of the Advance Section, Communications Zone, ETOUSA, covering the period from initial organization, October 1943, to inactivation, 10 July 1945, p. 238. [Official record.]

food allowances for prisoners of war as compared to the more austere diets for civilians forced to live under conditions of scarcity of food.⁷¹

Information about rations for prisoners of war was summarized by Col. Wendell H. Griffith, SnC, Chief of the Nutritional Branch, Division of Preventive Medicine, Office of the Chief Surgeon, European theater, as follows:⁷²

* * * Prisoners captured in Normandy in 1944 [and held in the United Kingdom] * * * were issued a ration which did not differ greatly from that supplied American troops [balanced; 3612 calories]. No distinction was made in the rations for working and nonworking prisoners.

POW on the continent were issued a similar ration until 7 December 1944, except that nonworkers received 20% less than workers. At this time the worker's ration was reduced from 3860 to 3258 calories; nonworkers received 10% less. Another reduction was made in April 1945. For the first time separate rations were authorized nonworkers because it was not feasible to make an overall percentage deduction in the worker's ration to bring the caloric level down to the 2000 calorie level ordered by the Theater Commander for nonworkers. These ration decreases were the result of the disparity between tremendous numbers of captured prisoners and the relatively small stocks of available foodstuffs. Furthermore, the 2000 calorie ration was authorized as the theater ration for displaced persons and others whose subsistence was the responsibility of G-5 [Assistant Chief of Staff for Civil Affairs-Military Government, G-5, SHAEF]. The earlier rations supplied nonworkers were in accordance with the Geneva Convention and were in excess of the actual requirements of the prisoners. This original policy was bitterly criticized by allied civilians because nonworking prisoners had more to eat than allied workers. Following the German surrender in May 1945, practically all the prisoners held by the Armies inside of Germany were classified as "disarmed forces" and their subsistence became the responsibility of the civilian food administration. POW in the Communications Zone remained on the POW ration.

The components of POW rations were mostly Quartermaster supplies originally intended for use in the troop ration. The quality, therefore, was good. The method of preparation preferred by the Germans was the concoction of a stew containing nearly all of the ration components. This was fortunate because it was possible to issue dehydrated potatoes and vegetables, which served the purpose admirably and which were less acceptable in the troop ration. Captured enemy flour was used as long as it lasted.

In February and March 1945 the Nutrition Branch was directed to investigate the nutritional status of POW in American custody. The survey team * * * examined 800 prisoners in representative work camps and enclosures. The results showed that the nutrition of prisoners who had been in American hands for 50 days or more was satisfactory and considerably superior to that of newly captured Germans. This indicated

⁷¹ There are voluminous records and reports on these matters in the historical files of the Medical Department and the Quartermaster Corps. Two main groups of Quartermaster Corps materials in archival, manuscript, and published forms are listed here. The Medical Department reports will be cited separately. (1) Ross, William F., and Romanus, Charles F.: *The Quartermaster Corps: Operations in the War Against Germany*. United States Army in World War II. The Technical Services. Washington: U.S. Government Printing Office, 1965. (2) Littlejohn, Robert M., editor and compiler, *Passing in Review*. This highly important collection of documents and commentaries, assembled and written in part by the former Chief Quartermaster, European Theater of Operations, U.S. Army, is in manuscript form in the Office of the Chief of Military History, Department of the Army, Washington, D.C.

⁷² Griffith, Wendell H.: *The Nutrition of Prisoners of War, Allied Nationals, and Others*. In Gordon, John E.: *A History of Preventive Medicine in the European Theater of Operations, U.S. Army, 1941-45*, vol. II, pt. IV, pp. 41-45. [Official record.]

that the POW ration in use during the early part of 1945 was superior to the ration of the German Army.

In August 1945 the Nutrition Branch was directed to make a second theater survey of the adequacy of the feeding of POW and of German disarmed forces. The 2000 calorie ration was found to be insufficient for German prisoners under 21 years of age and for others who were classed as nonworkers but whose caloric needs were significantly increased by fatigue duties, calisthenics or marching. The 2000 calorie ration was adequate for individuals who were inactive in fact. The German civilian ration issued to disarmed forces varied from 1200 to 1500 calories at that time and was inadequate. This was especially true because there was no opportunity for the men in the enclosures to supplement their rations as German civilians were able to do from gardens, household supplies, etc.

The two surveys referred to by Colonel Griffith were conducted in prisoner-of-war camps and enclosures in France, Germany, and Austria by Lt. Col. Herbert Pollack, MC, and his assistants, during April, May, and August 1945.⁷³ The conditions found during April and May were essentially satisfactory. The survey made in August, however, disclosed evidence of very extensive malnutrition among prisoners of war and disarmed enemy elements in the large enclosures maintained by the Third and Seventh U.S. Armies and by the Communications Zone. There was a lack of uniformity in the ration scales in various areas, and the caloric scales averaged below 2,000. There was consistent evidence of insufficient amounts of riboflavin and nicotinic acid in the prisoner-of-war diet.

There were several factors responsible for the vitamin deficiency of the German prisoner-of-war ration. Colonel Pollack reported as follows:

Previous survey, * * * 15 May 1945, has shown that the standard German Army ration had been deficient in riboflavin and nicotinic acid for some time. Superimposed upon this deficiency intake of fairly long standing was the variable period of severe deprivation of all nutrients during the final weeks of active campaign and [of unavoidably inadequate rations] in the forward POW enclosures. At best, the POW ration could only be expected to maintain an existing state; it was never designed as a therapeutic diet.

Florid deficiency syndromes related to the B complex vitamins were evident in the non-workers subsisting on American rations. While there was evidence, of these deficiency syndromes in those prisoners subsisting on locally procured German food, it was not as marked as in the group subsisting on the American ration. It is believed that this difference is due to the usage of some highly milled unenriched flour in the American ration, which furnishes a large proportion of the energy value of the ration. The German ration included a 95% extraction [of] flour [which supplied many of the B vitamins].

On the other hand, rations were good in the overrun German-operated hospitals caring for sick and wounded German prisoners of war.

⁷³ (1) Letter, Lt. Col. Herbert Pollack, MC, Headquarters, Theater Service Forces, European Theater, Office of the Theater Chief Surgeon, to Chief, Preventive Medicine Division, Office of the Chief Surgeon, European Theater, 31 Aug. 1945, subject: Report of Nutritional Survey of German Prisoners of War and Disarmed Enemy Elements Under Control of the United States Army on the European Continent. (2) Pollack, Herbert: Nutritional Disorders. In *Medical Department, United States Army. Internal Medicine in World War II. Volume III. Infectious Diseases and General Medicine*. Washington: U.S. Government Printing Office, 1968.

Increase in caloric value of prisoner-of-war rations.—The findings, and recommendations for increased caloric value of prisoner-of-war rations, as set forth in Colonel Pollack's report (August 1945), had an immediate and beneficial effect. On 15 September 1945, Maj. Gen. Robert M. Littlejohn, Chief Quartermaster of the European theater, forwarded the report to the Deputy Chief of Staff, European theater,⁷⁴ with this comment, among others: "From the attached report you will see that certain corrective action is immediately needed." Thereafter, the caloric value of the prisoner-of-war ration for nonworkers was increased to 2,200 calories, and was held at 2,900 calories for workers.

Food shortages.—Authorities of U.S. occupying forces were well aware of the food shortages in Germany and Austria and also in U.S. supply after V-E Day. The nutritional state of civilians, displaced persons, prisoners of war, and disarmed enemy forces was, therefore, a matter of constant concern, as many reports attest. Nutritional surveys were made by teams of experts. One of these, undertaken upon instructions from the Surgeon, Headquarters, 12th Army Group, with the concurrences of the Surgeon, Third U.S. Army, and the Surgeon, 65th Infantry Division,⁷⁵ was carried out from 8 to 23 July 1945 under the direction of Dr. Charles S. Davidson, Consultant, Surgeon General's Office, with two assistants. Among their investigations was a study of starvation in a group of men, disarmed forces (formerly prisoners of war), who had been held in an SS (*Schutzstaffel* (Elite Guard)) lager at Linz, Upper Austria, from 2 to 3 months, and used as laborers. The energy value of their diet varied from 650 to 850 calories—a starvation diet. These findings were reported to the Surgeon, 12th Army Group, and were published.⁷⁶

Feeding prisoners of war.—Experience with messing problems and nutritionally inadequate diets among prisoners of war because of lack of mess gear and cooking facilities pointed out the need for forethought and action regarding supplies, disciplining capturing troops in obedience to the Geneva Convention, and maintaining the interests of preventive medicine. Mess gear and water canteens are among the "effects and objects of personal use" which Article 6 of the convention specifies "shall remain in the possession of prisoners of war" (fig. 40) Through violations of this requirement, and through both thoughtlessness and misjudgment, mess gear and canteens were often taken from prisoners of war to their detriment and to the increase of the burden upon the detaining forces.

⁷⁴ Letter, Maj. Gen. Robert M. Littlejohn, Chief Quartermaster, Headquarters, Theater Service Forces, European Theater, Office of the Chief Quartermaster, to Brig. Gen. M. W. Gilland, Deputy Chief of Staff, Theater Service Forces, European Theater, 15 Sept. 1945, subject: Feeding and Care of Prisoners of War and Other Persons Under Military Custody of the United States.

⁷⁵ Hd., 65th Infantry Division, Office of the Surgeon, Report of Medical Department Activities in the 65th Infantry Division, January to June 1945.

⁷⁶ (1) Letter, Maj. Harold L. Wilcke, SnC, Charles S. Davidson, M.D., Consultant, and Pvt. Philip J. Reiner, Technician, to Surgeon, Headquarters, 12th Army Group, U.S. Army, 24 July 1945, subject: Nutritional Survey of the Population of Linz, Oberdonau, Austria. (2) Davidson, C. S., Wilcke, H. L., and Reiner, P. J.: A Nutritional Survey of Starvation in a Group of Young Men. *J. Lab. & Clin. Med.* 31: 721-734, July 1946.



FIGURE 40.—German prisoners of war in a mess line at a camp under the control of the Seventh U.S. Army, Sarrebourg, France, 10 January 1945. (U.S. Army photograph.)

Admittedly, however, the lack of these implements and facilities was frequently caused by the fact that U.S. supply could not furnish them in the numbers needed. Whatever the reasons, numerous reports and photographs testify to those deprivations. The following is an example:

During the closing phase of the war, General Bradley received a message that a German corps commander wanted to surrender his entire corps. General Littlejohn, who was at dinner with General Bradley, recommended that the offer of surrender be declined unless the Germans brought in all their unit mess equipment, and also all individual mess gear, blankets, and bedding.⁷⁷

General Bradley told about the following episode:⁷⁸

The PW tally [on 14 April 1945] had now outrun our ability to keep daily count. In one cantonment alone we had caged 160,000. The feeding of these PWs and DPs exerted an additional strain upon our overburdened supply lines and we instructed Army commanders not to accept prisoners streaming westward from the Russians. When a few days later the 11th Panzer Division in Czechoslovakia sent word that it

⁷⁷ Ross, William F., and Romanus, Charles F.: *The Quartermaster Corps: Operations in the War Against Germany*. United States Army in World War II. The Technical Services. Washington: U.S. Government Printing Office, 1965, p. 731.

⁷⁸ Bradley, Omar N.: *A Soldier's Story*. New York: Henry Holt & Co., 1951, pp. 544–545.

wished to surrender to U.S. forces, we invited them to come in "but only if you bring your own kitchens and can take care of yourselves."

Diseases Among Prisoners of War

It is not unusual that verifiable statistics of morbidity are an understatement of the amount of sickness occurring in a given place over a period of time. Certainly, this was true of the frequency of illnesses among German prisoners of war in the European theater during 1944-45. The statistics of diseases in this group are in terms of admissions to hospitals or dispensaries. It was well recognized, however, that in addition to those admitted to hospital there were many thousands among the hundreds of thousands remaining in the enclosures who were afflicted with acute attacks of diarrhea and dysentery. Casual reports of observers, lay as well as medical, support this estimate not only for enteric diseases, but also for acute respiratory tract diseases, malnutrition, and other disorders. The exact number of cases cannot be supplied; however, table 23 and the following tabulation on morbidity and mortality among German prisoners of war are informative and valuable as a basis for future planning of preventive medicine care for enemy prisoners.

During the period from September 1944 to the end of February 1945, there was a moderate amount of sickness among German prisoners of war in the enclosures in France and Belgium. This did not present any especially difficult problems. Beginning in March 1945, however, when the number of captives started to increase greatly and rapidly, overcrowding the compounds, sickness and death among prisoners increased importantly. Attention, therefore, will be given chiefly to the last 10 months of the war and a final 6-week period ending 15 June 1945, because the most reliable figures have been found in the records of those two periods.

For the 6-week period ending 15 June 1945, admissions and admission rates for diseases among prisoners of war in enclosures in Advance Section, Communications Zone, were greatly in excess of those in the U.S. Army in the same regions. In the enclosures during this period there were 345,324 admissions to hospital, giving a rate of 4,285 per 1,000 average strength. Among U.S. troops, there were 155,785 admissions, with a rate of 551. Among the German prisoners of war, there were 2,754 deaths from disease (34.2) and among U.S. troops there were 161 deaths (0.6). The admission rate for German prisoners of war was 7.8 times greater than for U.S. troops; the death rate from disease was 20.5 times greater than for U.S. troops. An average of 23 percent of all prisoners of war in Advance Section, Communications Zone, were seen at sick call each week.

Diarrhea and dysentery.—As Gordon⁷⁹ has pointed out, the most seri-

⁷⁹ Gordon, John E.: *A History of Preventive Medicine in the European Theater of Operations, U.S. Army, 1941-45*, vol. I, pt. III, sec. 2, No. 1, table 14, and p. 19.

TABLE 23.—*Admissions for 23 selected causes among German prisoners of war in enclosures, European Theater of Operations, U.S. Army, for 6-week period ending 15 June 1945*

[Rate expressed as number of admissions per annum per 1,000 average strength]

Cause for admission ¹	Number	Rate
Diarrhea and dysentery	159,842	349.24
Common respiratory disease	98,861	214.8
Tuberculosis	9,128	19.83
Venereal disease	7,624	16.56
Pneumonia	7,360	16.4
Vincent's angina	5,822	12.65
Scabies	4,465	9.7
Diphtheria	2,859	6.2
Malaria	2,661	5.78
Undulant fever	2,029	4.41
Infectious hepatitis	1,047	2.27
Typhoid fever	493	1.07
Paratyphoid fever	420	.91
Scarlet fever and streptococcal sore throat	294	.8
Rheumatic fever	203	.44
Tetanus	70	.15
Typhus	55	.12
Dengue	29	.1
German measles	29	.1
Measles	22	.09
Poliomyelitis	8	.0
Relapsing fever	1	.0
Trench fever	1	.0

¹ Additional significant causes for admission, as reported in various hospital records, were encephalitis, meningitis, cardiac insufficiency, nephritis, peptic ulcer, septicemia, malnutrition, emaciation and dehydration, exhaustion, and injuries.

Source: Essential Technical Medical Data, European Theater of Operations, U.S. Army, for July 1945, dated 25 Aug. 1945, inclosures 13 and 14.

<i>Cause of death</i>	<i>Number</i>
Diarrhea and dysentery (bacillary)	833
Cardiac disease	811
Pneumonia	267
Exhaustion	192
Diphtheria	40
Emaciation and dehydration	31
Typhoid fever	30
Meningitis	25
Septicemia	25
Tuberculosis	20
Nephritis	17
Tetanus	13
Miscellaneous	450
Total	2,754

ous problems were the diarrheas and bacillary dysenteries (chiefly Flexner types) which occurred among enemy prisoners of war in the enclosures on the continent of Europe. During 1944 and the first quarter of 1945, rates relatively low for these diseases among prisoners of war were about 10 times as great as those for U.S. troops. The high rate for December 1944, 185.4 per 1,000 prisoners per annum, was associated with the reception of large numbers captured in the Battle of the Bulge. The rates gradually dropped to 74.6 in April 1945. In May 1945, following the capture of many thousands of prisoners and their crowding in inadequate enclosures in bad weather under unsanitary conditions, 80,952 cases of diarrhea and dysentery were reported, raising the rate to 734.6 per 1,000. In June, 60,978 cases were reported, with a rate of 326.9 per 1,000. There were 833 deaths from diarrhea and dysentery among prisoners in the enclosures in Advance Section, Communications Zone, during the 6-week period ending 15 June 1945.

In a final comment on diarrhea and dysentery among prisoners of war in enclosures, Philbrook and Gordon wrote:⁸⁰

Hospitals had been established to take care of seriously ill patients. As rapidly as possible, water supplies were increased, and messing and sanitary facilities were improved. Before the end of May, remarkable accomplishments in prison-enclosure sanitation had been made. But dysentery had taken over with a speed greater than that necessary for the institution of proper preventive measures.

Typhoid and paratyphoid fevers.—The record of prisoners of war with respect to typhoid and paratyphoid fevers had been excellent during the early months of the campaign.⁸¹ The German Army was well immunized, but the protection provided by typhoid-paratyphoid immunization could not withstand the infectious assaults delivered by contaminated water and the foul conditions which existed in the enclosures when the avalanche of prisoners poured into them in May 1945. Among German prisoners of war from September 1944 through April 1945, there were only 11 cases of typhoid and 4 cases of paratyphoid. In May, there were 29 and 4 cases, respectively. Suddenly, in June 1945, there were 453 cases of typhoid and 412 cases of paratyphoid. Numerous cases among recently captured German soldiers indicated that infection had occurred at some of the forward collecting points. In the 6-week period ending 15 June 1945, there were 30 deaths from typhoid fever among 403,142 German prisoners of war in Advance Section, Communications Zone.⁸²

Diphtheria.—Diphtheria was prevalent in France, the Netherlands, and

⁸⁰ Philbrook, Frank R., and Gordon, John E.: Diarrhea and Dysentery. In Medical Department, United States Army. Preventive Medicine in World War II. Volume IV. Communicable Diseases Transmitted Chiefly Through Respiratory and Alimentary Tracts. Washington: U.S. Government Printing Office, 1958, p. 358.

⁸¹ Kuhns, Dwight M., and Learnard, Donald L.: Typhoid and Paratyphoid Fevers. In Medical Department, United States Army. Preventive Medicine in World War II. Volume IV. Communicable Diseases Transmitted Chiefly Through Respiratory and Alimentary Tracts. Washington: U.S. Government Printing Office, 1958, p. 477.

⁸² Gordon, John E.: A History of Preventive Medicine in the European Theater of Operations, U.S. Army, 1941-45, vol. I, pt. III, sec. 2, No. 3, pp. 1-11 and tables 1-6.

Germany in 1941, throughout the war years, and afterward. It was not surprising, therefore, as Gordon⁸³ and McGuinness⁸⁴ have pointed out, that the incidence among U.S. troops, who were largely nonimmune, should have increased during the campaign on the Continent. During the first 6 months of 1945, 1,037 cases were reported in U.S. troops, with an overall rate of 0.76 per 1,000 per annum, rising to 1.05 for April. Among German prisoners of war, a smaller population, the number of cases (2,859) was double, and the rates greater by about 10 times those among U.S. troops. The carrier rate for diphtheria bacilli in some of the enclosures was exceedingly high. Diphtheria was a serious problem among German prisoners of war in enclosures on the continent of Europe.

While the war was coming to its end, it was recognized that the high incidence of diphtheria among German prisoners and civilians indicated that this disease was to become one of the major health hazards for the army of occupation after the war. With his usual foresight, Maj. Gen. Paul R. Hawley, Chief Surgeon, European theater, requested The Surgeon General to arrange for an investigation of problems of diphtheria in the military and civilian populations of the European theater. This investigation was carried out by Lt. Col. Aims C. McGuinness, MC, and Dr. J. Howard Mueller, representing the Army Epidemiological Board (formerly Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army), during the period 19 June to 18 August 1945. The findings and conclusions will not be reviewed here. The later beneficial work is mentioned here because one stimulus for the undertaking was the experience with diphtheria among German prisoners of war.

Typhus fever (epidemic, louseborne).—Under the direction of Colonel Gordon,⁸⁵ and in part, the United States of America Typhus Commission, through the awareness of medical officers, and by the abundant use of DDT insecticide powder (fig. 41), typhus control was so intelligently and effectively carried out that the disease, which might have been catastrophic, was of minor significance among German prisoners of war in the European theater. Colonel Gordon reported, as follows:

The first confirmed typhus fever to appear among German prisoners of war was in March 1945 [at Remagen]. A large proportion of recently taken prisoners were found infested with lice, and very few had been vaccinated against typhus fever. Theoretically the conditions favored sizeable outbreaks, but because of the strict control under which prisoners were held, preventive measures [particularly mass delousing, however, as just noted] were more than usually effective.

The number of cases of typhus fever reported among German prisoners of war was 90: 3 in March, 21 in April, and 66 in May 1945. No

⁸³ Gordon, John E.: *A History of Preventive Medicine in the European Theater of Operations*, U.S. Army, 1941-45, vol. I, pt. III, sec. 4, p. 9 and tables 11 and 12.

⁸⁴ McGuinness, Aims C.: *Diphtheria*. In *Medical Department, United States Army. Preventive Medicine in World War II. Volume IV. Communicable Diseases Transmitted Chiefly Through Respiratory and Alimentary Tracts*. Washington: U.S. Government Printing Office, 1958, pp. 182-183.

⁸⁵ Gordon, John E.: *A History of Preventive Medicine in the European Theater of Operations*, U.S. Army, 1941-45, vol. I, pt. III, sec. 5, No. 1, p. 46.



FIGURE 41.—German prisoners of war captured by the Third U.S. Army delouse new arrivals at an enclosure near Stenay, France, by dusting them with DDT insecticide powder, 28 March 1945. (U.S. Army photograph.)

frank outbreaks of typhus fever occurred in any of the prisoner-of-war enclosures.

Nephritis (field or trench).—The incidence of acute nephritis was much higher among German prisoners of war than among American troops. The German medical officers were of the opinion that included in this group was a distinctive disease which they called “field nephritis” or “trench nephritis.” The disease was not reported in U.S. troops.

This type of nephritis among German prisoners of war was investigated by Col. Yale Kneeland, Jr., MC, Colonel Pollack, and Capt. Leonard Horn, MC.⁸⁶ One difficulty was that trench nephritis had never been described as a clear-cut clinical entity. Nevertheless, German medical officers thought that they could distinguish it sufficiently. As a result of his serologic investigations, Colonel Kneeland concluded, in general, “that the thought among U.S. medical officers is toward glomerulonephritis of streptococcal origin.” This was in line with German opinion. Colonel Pollack and Captain Horn, on the other hand, concluded that: “The evidence suggests that there is a nutritional factor in the etiology of this syndrome. No specific nutrient has been implicated. The nutritional factor may be secondary and an infective agent may be the primary factor.”

⁸⁶ Essential Technical Medical Data, European Theater of Operations, U.S. Army, for June 1945, dated 13 Aug. 1945. Inclosure 16, 10 June 1945, subject: Report of Survey of Edema of Undetermined Etiology (“Trench Nephritis”); Inclosure 17, 20 June 1945, subject: Report on Acute Nephritis in Prisoners of War.

Supervision of Captured Military Hospitals

When German military hospitals were overrun, the patients in them became prisoners of war. Another responsibility which fell upon the victors was the supervision of sanitary matters and the medical and surgical care of the sick and wounded therein. Adequate consideration of these affairs is beyond the scope of this chapter, but mention of the problems is appropriate here because the consequent burden made it all the more difficult for personnel in combat to carry out a preventive medicine program for enemy prisoners of war. A vivid indication of these aspects of the work is given by the following personal communication from Colonel Coates, Deputy Surgeon, Third U.S. Army.

Indeed this became a heavy chore for the field armies. At one time (at the conclusion of the war), the Third U.S. Army was operating 144 captured hospitals filled with sick and wounded prisoner-of-war patients. As quickly as possible, men were discharged from the Army and hospitals. (SS troops of grade of corporal and above were the exception for some time.) Malingering by POW's was a problem for a time. To deal with this required special judgment on the part of U.S. military personnel. Drugs, medicines, food, and sanitary materials (soap, etc.) had to be supplied by U.S. personnel. Captured goods were used where possible. But logistics was a problem, with transport critical very often. Because of heavy demands on MC officers elsewhere, it was not unusual for an MSC officer or high-ranking NCO to be in charge of a captured German hospital or group of hospitals.

Discharge and Disbandment of Enemy Forces

Although the terminal date for the official history of the Medical Department of the U.S. Army in World War II is 31 December 1945, the author of this chapter felt that it would be better to end it as of about 30 June 1945, after introducing accounts of a few episodes needed to complete bits of an ongoing record. Actually, after V-E Day, 8 May 1945, there were, technically speaking, no more German prisoners of war in the European theater. The remnants of the German Army were classed as surrendered military personnel or disarmed enemy forces (at no little strain upon provisions of the Geneva Convention). Although these people were discharged and disbanded as rapidly as possible, a year or more was required to complete the process, during which much of the misery in the enclosures, previously described, was repeated. Another volume of this history would be needed to record the events in the immediate aftermath of the war relative to former enemy prisoners of war.

Commenting on the disbandment of enemy forces, the Assistant Chief of Staff for Personnel, G-1, Third U.S. Army, stated:⁸⁷

While the subject of disbandment of enemy forces is one of a post-hostilities nature, experience proved that grandiose plans for complete and orderly disbandment of a

⁸⁷ After Action Report, Third U.S. Army, 1 August 1944-9 May 1945. Vol. II, Staff Section Reports; Part 2, G-1 Section, p. (G-1) 15.

defeated enemy are useless when no semblance of enemy organization remains. Procedures prescribed and reports required for the disbandment of German disarmed forces proved highly impracticable in that they anticipated the complete utilization of the enemy army as an integral unit. Effective use was made of German individuals as interpreters, but German units as such were in most cases non-existent.

The disappearance of organized German units increased the difficulties of carrying on preventive medicine activities.

The European theater came to an end on 30 June 1945. It was succeeded by United States Forces, European Theater, with a Division of Preventive Medicine, whose chief was Col. Tom F. Whayne, MC, to take over from the Division of Preventive Medicine, European theater, and to deal with many complex problems.

Evaluation

One optimistic estimate and one considered accolade is quoted to uplift the preceding dreary narrative of the handling of enemy prisoners of war in the European theater during the victorious campaign of 1944-45.⁸⁸

In addition to being able to move huge tonnages in the last months [of the war], the logistic organization was in a much better position to meet the demand for specific items of supply. The U.S. Communications Zone was supporting 3,675,000 troops, plus 1,560,000 prisoners of war as hostilities came to an end early in May 1945. On the whole, supply of these forces was better than it had been at any time since the beginning of the pursuit in the summer of 1944.

In 1950, General Lucius D. Clay expressed a retrospective opinion with an appreciative and generally favorable assessment, as follows:⁸⁹

In looking back, I think that if we had then realized the confusion and chaos which existed we would indeed have thought ours a hopeless task. Certainly the authorities in Washington who had prepared our policy directive did not visualize these conditions. They did not know of the heavy burden performed so well under the circumstances by the Military Government teams which accompanied the combat troops and were engaged even before the surrender of Germany in re-creating some form of local administrative machinery at the city and county level and in re-establishing at least locally law, order, and public services.

* * * * *

Food shortages made it more difficult and more important to take adequate measures to maintain public health for humanitarian reasons and to protect the health of the occupying forces. Bombed and partially destroyed cities, damaged water supplies, crowded dwellings, and hundreds of thousands of displaced persons, refugees, [disarmed enemy forces], and expellees leaving and arriving daily, created the conditions in which epidemics develop. Our Military Government teams [and the regular Medical Department organizations] were staffed with public health specialists under the able leadership of Major General Morrison C. Stayer, and their work was little short of miraculous.

⁸⁸ Ruppenthal, Roland G.: *Logistical Support of the Armies. United States Army in World War II. The European Theater of Operations.* Washington: U.S. Government Printing Office, 1959, Volume II, September 1944-May 1945, p. 433.

⁸⁹ Clay, Lucius D.: *Decision in Germany.* Garden City, N.Y.: Doubleday & Co., Inc., 1950, pp. 16, 272.

THE PACIFIC AREAS

The problems of operating a program of preventive medicine for prisoners of war in the Pacific areas were smaller than they were in North Africa and Europe. Nevertheless, they were arduous and had special peculiarities. At times, these problems put a heavy burden upon personnel of the medical, provost marshal, quartermaster, and transportation services, and also upon combat troops used for guard and escort duties. The satisfaction of even the minimal needs of the program taxed supplies in areas that often had barely enough for U.S. troops, operating in a region larger than the entire continental United States. Jungle warfare and tropical diseases created new and difficult conditions.

For the convenience of this account, these vast areas, shown in map 9, are divided into the following somewhat unorthodox sections:

1. The southern portion of the Pacific Ocean Areas (the Mariana, Marshall, Caroline, and Gilbert Islands), and the northern third of the South Pacific Area (the Solomon Islands, especially Guadalcanal), 1942-44.

2. New Guinea and adjacent islands (the Papuan Campaign, the long approach to the Philippines, and the landing on Leyte Island), 23 July 1942-17 October 1944.

3. The Philippine Islands (from the conquest of Leyte to the liberation of Luzon, and the succeeding 6 months), 17 October 1944-30 June 1945; 31 December 1945.

4. The Ryukus Campaign (Okinawa), 1 April-14 August 1945 (V-J Day), and official surrender of Japan, 2 September.

Guadalcanal

Only brief mention will be made of the scarcity of Japanese prisoners of war and the attitudes of soldiers, although many severe amphibious assaults and island battles were fought to destroy the Japanese forces. Thousands of troops were engaged, but few prisoners were taken. This characteristic of the first fighting persisted throughout the war against Japan until the general breakdown a few weeks before V-J Day in August 1945. The small numbers of the captures of Japanese prisoners of war is explained by the attitudes of the soldiers on both sides. The reason has been clearly stated by Miller⁹⁰ in his account of the Guadalcanal Campaign. During this campaign, which lasted from 7 August 1942 to 21 February 1943, very few Japanese prisoners were taken. Writing retrospectively, Miller has stated:

* * * Apparently the Japanese belief that it is dishonorable to surrender had led the *Imperial Army* to neglect to instruct soldiers on what to do if captured * * *. But

⁹⁰ Miller, John, Jr.: *Guadalcanal: The First Offensive*. United States Army in World War II. The War in the Pacific. Washington: U.S. Government Printing Office, 1949, p. 310.



MAP 9.—Pacific Ocean Areas, Southwest Pacific Area, and a portion of the South Pacific Area (lower right corner), showing the approximate boundaries, 1942-45.

very few Japanese soldiers ever gave themselves up voluntarily. The American troops, who were fearful of the widely publicized treacherousness of the enemy, were reluctant to take prisoners, and the Japanese soldiery usually fought until they were killed rather than capitulate.

This is abundantly confirmed by comments in documents from the Pacific area.

Papua

During the Papuan Campaign⁹¹ (23 July 1942–23 January 1943), less than 100 Japanese soldiers were captured, and they were so debilitated by malnutrition, malaria, and neglected wounds that they were treated as hospital patients rather than as able-bodied prisoners. While extra surveillance was needed to make them eat, and to keep the stronger prisoners from kicking the weaker to death, no special provisions had to be made for preventive medicine for them. An episode described in a report of the 3d Portable Surgical Hospital,⁹² January 1943, at the end of the Buna Campaign, is typical:

We received eleven Japanese patients and about fifteen Chinese. One Jap * * * had a fulminating peritonitis and died in four days. The remaining cases were compound fractures and shrapnel wounds requiring debridement and reductions and casts. All of the Japanese had malaria and most of them had worms of one sort or another, usually ascaris. They were a terribly malnourished and debilitated lot. As patients they were uncooperative and surly, often refusing food or care. Eight of them were placed in one tent together. * * * The stronger ones at night would try to kick the weaker ones to death and had to be carefully watched.

Shortly after the end of the campaign in Papua, and at about the beginning of General Douglas MacArthur's advance along the northern coast of New Guinea in the approach to the Philippines, two actions were taken by General Headquarters, Southwest Pacific Area, and General Headquarters, U.S. Army Forces in the Far East, that had an overall good influence upon the handling of Japanese prisoners of war. These were:

1. *Detainment in Australia.*—Early in 1943, the Commander in Chief, General Headquarters, made an agreement with the Australian Government⁹³ providing that all prisoners of war captured by U.S. forces in the Southwest Pacific Area south of 5° north latitude would be detained in Australia. Such prisoners were thereafter evacuated to Australia and were administered by the Royal Australian Army's Department of Prisoners of War. Compounds were established in healthy places, chiefly at Brisbane, where the Gaythorne Internment Camp was designated as the reception center for all prisoners of war entering Australia. As the detaining power, Australia maintained contact with the International Committee of the Red Cross, and made all reports required by the Geneva Convention, sending copies to the provost marshal of the area. This arrangement worked out well, except for an occurrence of violence at a prison camp in New South Wales in August 1944 when shackled prisoners and others not bound tried to break out of the barbed wire enclosure. Of these rioters, 200 were killed and 200 were wounded.

⁹¹ Milner, Samuel: *Victory in Papua*. United States Army in World War II. The War in the Pacific. Washington: U.S. Government Printing Office, 1957.

⁹² Quarterly Report, Headquarters, 3d Portable Surgical Hospital, USASOS, 1 Jan.–31 Mar. 1943, dated 1 July 1943.

⁹³ (1) *Administrative History*, Office of the Chief Provost Marshal, General Headquarters, U.S. Army Forces in the Pacific, 6 Apr. 1945 to 31 Dec. 1946. [Official record.] (2) *The Provost Marshal's History, 1941–47. Campaigns in the Pacific*. Chapter VI, Prisoner of War Operations.

By August 1943, only 160 enemy prisoners of war had been held for the U.S. Army by Australian authorities. But this changed in the succeeding months. By the end of 1943, American-captured Japanese prisoners of war in Australian custody numbered 604, and by the beginning of the Philippine Campaign in October 1944, the number had risen to 4,435. These were chiefly enemy prisoners of war captured by the Sixth U.S. Army, under General Walter Krueger,⁹⁴ during the advances in New Guinea and the Bismark Archipelago, as follows:

Arawe, Cape Gloucester, Saidor (15 Dec. 43–10 Feb. 44)	367
Admiralty Islands (29 Feb.–18 May 44)	124
Hollandia, Aitape, Tanahmerah (22 Apr.–25 Aug. 44)	819
Wadke and Biak Islands (17 May–2 Sept. 44)	835
Noemfoor Island (2 July–31 Aug. 44)	889
Sansapor (30 July–31 Aug. 44)	246
Morotai Island (15 Sept.–4 Oct. 44)	1
Total	3,281

Evacuation to Australia of Japanese prisoners of war captured by U.S. forces ended soon after the American landing on Leyte Island on 17 October 1944.

2. *USAFFE Regulations No. 80–40*.—On 30 May 1943, the Provost Marshal's Office at General Headquarters, U.S. Forces in the Far East, secured the issuance of a broad and detailed regulation⁹⁵ prescribing policy and procedures for dealing with enemy prisoners of war, "for the guidance of all concerned with custody and administration of prisoners of war and enemy alien civilian internees in areas under jurisdiction of this Headquarters." The basic authorities cited were the Geneva Prisoner of War Convention of 27 July 1929, the War Department prisoner-of-war circulars, and the pertinent technical manuals and Army regulations.

Philippine Islands

In the Philippine Islands Campaign, from Leyte⁹⁶ in 1944 to Luzon in 1945, U.S. Army forces provided facilities for the detention of Japanese prisoners of war, and hence had increased responsibilities for the program of preventive medicine for those prisoners. Numerous prison camps, large and small, were established, as the Sixth and Eighth U.S. Armies advanced on Leyte, Samar, Mindanao, Mindoro, and Luzon Islands (fig. 42). Medical and sanitary officers were detailed to these camps. All of the main prisoner-of-war camps included some type of hospital (station or evacuation)

⁹⁴ (1) Krueger, Walter: *From Down Under to Nippon. The Story of Sixth Army in World War II*. Washington: Combat Forces Press, 1953. (2) Smith, Robert Ross: *The Approach to the Philippines*. United States Army in World War II. The War in the Pacific. Washington: U.S. Government Printing Office, 1953.

⁹⁵ USAFFE Regulations No. 80–40, Processing Prisoners of War Captured by United States Forces and Disposition of Personal Effects of Enemy Dead, 20 May 1943, and final reissue as AFPAC Regulations No. 80–40, Prisoners of War and Enemy Alien Civilian Internees, 7 May 1946.

⁹⁶ Cannon, M. Hamlin: *Leyte: The Return to the Philippines*. United States Army in World War II. The War in the Pacific. Washington: U.S. Government Printing Office, 1954.



FIGURE 42.—Japanese prisoners of war captured by the 38th Infantry Division in the mopping-up operation east of Manila, Philippine Islands, are detained in a barbed wire enclosure, 19 July 1945. (U.S. Army photograph.)

within the compound or enclosure in which were confined both able-bodied and sick and wounded prisoners.

The sanitary conditions and preventive medicine measures varied from poor in the early stages of shortages of personnel and facilities to satisfactory in the later stages when the entire public health situation in Manila and the islands was improved, notably through the intelligence and energy of Col. Maurice C. Pincoffs, MC, who in addition to many duties as Chief, Professional Services, and Chief Consultant in Medicine, directed the policies and activities of the Preventive Medicine Section, Office of the Chief Surgeon, U.S. Army Forces in the Far East, Southwest Pacific Area. As soon as possible after prisoners had been assembled at a camp, the requirements of Regulations No. 80-40 were applied faithfully. This was not easy to do, however, because of the extent of problems that could not be solved with the means at hand. In addition, among the captors there were impulses toward revenge and retaliation which tended to impede preventive medicine practices. It was clearly understood that the Geneva Convention and implementing rules required "decent treatment" of Japanese prisoners, no matter what stories were circulating of the

cruelty of Japanese masters. At the time when these prisoners in increasing numbers were coming into the custody of U.S. Army units, accounts of atrocities committed by the Japanese upon American prisoners of war in their hands became widespread. Reports of prison camps under U.S. administration, however, indicate that barbarism manifested by the enemy was met by strict adherence to humanitarian principles, and by constant efforts to raise the level of sanitation in the prison enclosures (fig. 43).

A few examples of the initial physical conditions of the Japanese prisoners of war are cited:

During April, May, and June 1945, at Old Bilibid Prison, New Bilibid Prison, and Iwahig Penal Colony, the rapid increase in prisoners of war confined in those places made it very difficult to maintain satisfactory sanitary standards. A high percentage of prisoners were found to be infected with malaria and dysentery; many showed extreme malnutrition. Malaria Control Units worked in the New Bilibid area and elsewhere to reduce the prevalence of flies and mosquitoes. Additional latrines were built. A sanitary officer was placed on duty at New Bilibid Prison to assist in the supervision of sanitation. In addition, sanitary inspections were made at Cavite, Leyte, Tarlac, and Pangasinan Provinces.⁹⁷

The prevalence of amebic and bacillary dysentery among prisoners of war at a camp near Manila overtaxed latrine facilities during July, August, and September 1945, causing a health hazard for the surrounding U.S. personnel as well as for the prisoners.⁹⁸

The poor nutritional state of Japanese prisoners of war taken in the Philippines in 1945 created serious difficulties for both hospitals and sanitary facilities. With regard to these nutritional disorders and their consequences, Pollack wrote,⁹⁹ as follows:

When the tide of battle had turned, with defeat after defeat for the Japanese in the Philippine Islands in the spring of 1945, these enemy troops, as evacuation from the islands presented difficulties, retreated into the hills back of Luzon, breaking up into small groups and living off the land. Owing to the hostility of the natives and the scarcity of eatable food in the mountains, these men suffered severe deprivation, particularly starvation phenomena. [The diet had furnished from 800 to 1,000 calories per day.] Coupled with this were the dysenteries, malaria, and other diseases indigenous to this part of the world—maladies that ordinarily deplete metabolic reserves of human beings.

After * * * 2 September 1945, these isolated Japanese troop units surrendered by the thousands to the U.S. Army. By early October, approximately 80,000 had been confined in New Bilibid Prison, Manila. Nearby was the 174th Station Hospital, a 250-bed installation. This hospital was burdened suddenly with the care of approximately 5,700 of these returned Japanese, many of whom were too ill even to move from their cots. It is reported that many died en route on the troop trains that brought the prisoners in. It was decided, as recommended by the Chief Surgeon, AFWESPAC (U.S.

⁹⁷ Headquarters, Military Police Command, AFWESPAC, Office of the Surgeon, subject: Quarterly History of Medical Department Activities (April, May, and June 1945), dated 28 July 1945.

⁹⁸ Headquarters, 17th Station Hospital, Manila, subject: Quarterly Report for History of Medical Activities (July, August, and September 1945), dated 17 Oct. 1945.

⁹⁹ See footnote 73 (2), p. 391.



FIGURE 43.—Japanese prisoner-of-war camp near Dagupan, Luzon, Philippine Islands, 24 February 1945. (U.S. Army photograph.)

Army Forces, Western Pacific), and by others, that a special study should be made of the clinical aspects of this severe malnutrition. [Beri-beri, both wet and dry types, was common.]

During July, August, and September 1945, Japanese prisoners of war were received at "strong points" of the 129th Infantry Regiment and other units, as at Gonzaga, Capissayan, San Jose, Tuguegarao, Lal-Lo, and Aparri. At the time of surrender, they crowded in, bringing their diseases with them. Regimental surgeons and other officers inspected the stockades periodically to make sure that proper medical facilities were available and that a satisfactory state of camp sanitation was being maintained. Mimeographed Japanese translations of sanitary regulations were posted. These regulations "did not differ appreciably from the usual regulations in force in our own camps except that the importance of and the technique to be observed in maintaining good sanitation was more strongly emphasized."¹⁰⁰

Toward the end of 1945, conditions in the prison camps and their associated hospitals had greatly improved. An inspection ordered by the Chief Surgeon, General Headquarters, U.S. Army Forces in the Pacific, Brig. Gen. Guy B. Denit, was made on 2 and 3 November 1945 at New

¹⁰⁰ Quarterly Report, Medical Detachment, 129th Infantry Regiment, SWPA, July, August, and September 1945.

Bilibid Prison and Prisoner of War Camp No. 1 at Canlubang by Col. I. Ridgeway Trimble, MC, Consultant in Surgery, Lt. Col. Clarke H. Barnacle, MC, and Col. Albert R. Dreisbach, MC, chairman of this special committee. Their report¹⁰¹ included observations on the sanitary conditions of the camps as well as on medical and surgical care of the patients. Illustrated by snapshots of screened kitchens, well-built and screened latrines, and a variety of sanitary facilities, the report presented good evidence that a preventive medicine program for enemy prisoners of war was in effective operation on Luzon at this time.

Okinawa

During the 83 days (1 April–22 June 1945) of the costly conquest of Okinawa—the last battle of the U.S. Army in the war against Japan—7,401 Japanese soldiers were captured by the Tenth U.S. Army. Of these prisoners, less than 4 a day were taken during the first 70 days. This number increased to more than 50 a day between 12 and 18 June. On 19 June, 343 enemy soldiers surrendered voluntarily, and on 20 June, 977 prisoners were taken. Mass surrender of the fanatical enemy soldiers occurred only during the last days of the fighting, when the remnants of the Japanese 32d Army were driven almost to the water's edge in the southern point of the island—at Hill 89 near Mabuni and in pockets between Medeira and Makabe, Hill 85, on 22 June. This shortened the period of preventive medicine activities in relation to enemy prisoners of war, but the difficulties were considerable.

The authors of the volume *Okinawa: The Last Battle*¹⁰² have noted certain characteristics of the fighting which show how little need, or opportunity, there was for a preventive medicine program for enemy prisoners of war during that battle, as follows:

Nothing illustrates so well the great difference between the fighting in the Pacific and that in Europe as the small number of military prisoners taken on Okinawa. At the end of May the III Amphibious Corps had captured only 128 Japanese soldiers. At the same time, after two months of fighting in southern Okinawa, the four divisions of the XXIV Corps had taken only 90 military prisoners. The 77th Division, which had been in the center of the line from the last days of April through May, had taken only 9 during all that time. Most of the enemy taken prisoner either were badly wounded or were unconscious; they could not prevent capture or commit suicide before falling into American hands.

¹⁰¹ (1) Report, Col. Albert R. Dreisbach, MC, Col. I. Ridgeway Trimble, MC, and Lt. Col. Clarke H. Barnacle, MC, Office of the Chief Surgeon, General Headquarters, U.S. Army Forces in the Pacific, to Chief Surgeon, General Headquarters, U.S. Army Forces in the Pacific, 9 Nov. 1945, subject: To Determine and Report the Status of Medical Care Being Furnished Japanese Prisoners of War and Internee Patients at New Bilibid Prison and POW Camp #1 at Canlubang. (2) Parsons, Wm. Barclay, Trimble, I. Ridgeway, and Eaton, George O.: Southwest Pacific Area. In Medical Department, United States Army. Surgery in World War II. Activities of Surgical Consultants. Volume II. Washington: U.S. Government Printing Office, 1964, pp. 687–765.

¹⁰² Appleman, Roy E., Burns, James M., Gugeler, Russell A., and Stevens, John: *Okinawa: The Last Battle*. United States Army in World War II. The War in the Pacific. Washington: U.S. Government Printing Office, 1948, p. 384.

In the light of these prisoner figures there is no question as to the state of Japanese morale. The Japanese soldier fought until he was killed. There was only one kind of Japanese casualty—the dead. Those that were wounded either died of their wounds or returned to the front lines to be killed. The Japanese soldier gave his all. [There were 110,071 Japanese soldiers killed on Okinawa, as compared with 12,281 American soldiers, sailors, and marines killed.]

Disease conditions among Japanese troops and prisoners of war on Okinawa.—More than half of all the Japanese prisoners of war captured on Okinawa were sick or wounded, and most of them were undernourished, indicating conditions against which planning for a preventive medicine program for enemy prisoners of war in that region would have to be directed. As in the Philippines, the prisoner-of-war enclosures were a combination of hospital and prison, about both of which the medical officers could speak with authority. One medical officer, Col. James B. Stapleton, MC, Surgeon, Okinawa Base Command, vividly described conditions in his report for the year 1945.¹⁰³ A few illustrative excerpts are quoted, as follows:

The unprecedented surrender of Japanese soldiers towards the close of the combat phase brought with it a proportionate increase in the number of Prisoner of War patients. This was not fully anticipated and special provisions for their hospitalization had to be made. On 30 June 1945, Island Command hospital units were treating 1,065 patients in their wards. The majority of patients were received in very poor physical condition in addition to the severity of their wounds. Approximately 75 percent suffered from partial starvation, dehydration and avitaminosis. The Japanese had been given no protective inoculations against tetanus and about fifty cases of tetanus were treated. None contracted tetanus after operations at our hospitals. * * * The first approach to mass surrender witnessed in the Pacific Theater gave some indication of the extensive medical care [and preventive medicine activities] which had to be provided for prisoners of war and enemy civilians as we entered the final phase of the war with Japan.

The 88th Field Hospital * * * was designated as the Prisoner of War Hospital for the Ryukyu Islands. Since it began operation in that capacity this hospital has treated over 3,000 Prisoners of War. The most trying period was the last week of June when it treated both American and Japanese patients. The days were spent in treating American casualties and the nights in caring for the Japanese. The latter patients were grossly infected; their bodies were unwashed and their wounds were filled with maggots. * * * The variety of lesions were legion: compound fractures, aneurysms, foreign bodies in every conceivable location, malnutrition, beri-beri, tetanus, osteomyelitis and empyema.

Colonel Stapleton continued with a description of some of the insanitary conditions discovered by malaria control units in former Japanese positions.

* * * One of the first special assignments which the unit [222d Malaria Survey Detachment] received was to survey the area around the town of Shuri to determine the amount of work necessary to eliminate a fly hazard from the decaying bodies of Japs who had not yet been buried. One fly breeding place was discovered in the network of caves which ran under the castle of Shuri. After one investigation it was decided that attempting to clean up these caves was too hazardous, and they were finally

¹⁰³ Headquarters, Okinawa Base Command, Office of the Surgeon, subject: Annual Medical History, 1945, dated 5 Jan. 1946.

blasted shut to eliminate the nuisance. The filth encountered during the inspection was a vivid revelation of the unbelievable conditions under which the Jap troops defending Shuri lived during the siege. One cave, which was explored for some hundreds of feet, was ankle deep in a fermenting, slimy mud which reeked of decaying rice and filth and from which myriads of tropical green-bottle flies (*Chrysomya megacephala*) were emerging. This passage apparently had been the sleeping quarters of around two hundred soldiers. Upon emerging, our personnel had to dust themselves thoroughly with DDT insecticide to drive off hundreds of fleas (*Pulex irritans*—the human flea) which had gotten into their clothes in the caves. Yet the Japs lived in these underground barracks for weeks, and some were doubtlessly still hiding there since one was shot nearby the next night.

Risk of spread of filariasis from Okinawa by prisoners of war.—During the period from April to the end of December 1945, surveys revealed that there was no schistosomiasis, no scrub typhus, and very little malaria on Okinawa. Among the natives, however, 30 percent were found to be infected with filaria (*Wuchereria bancrofti*). It was estimated later that a similar high incidence of filariasis existed among the Japanese prisoners of war captured on the island. As these prisoners, in considerable numbers, approximately 4,000, were transferred to Hawaii (Oahu) and to the continental United States, the possibility of the introduction of the disease into previously exempt areas, where the vector was present, became a matter of urgent concern. However, the danger was promptly eliminated by vigorous action on the part of Col. Arthur B. Welsh, MC, Acting Surgeon, Headquarters, U.S. Army Forces, Middle Pacific, in July 1945, and through vigorous support of The Surgeon General, as recommended by his Preventive Medicine Service.¹⁰⁴ The shipment through Hawaii of prisoners of war known to have microfilariae in their blood was stopped, and previously detected cases were returned to islands in the Pacific where filariasis was endemic.

Japan

Fortunately, V-J Day (14 August) and the signing of the surrender agreement (2 September) saved the Army from enormous tasks that otherwise would have had to be carried out under combat exigencies. One of these would have been concerned with preventive medicine for enemy prisoners of war.

According to General Charles A. Willoughby's account¹⁰⁵ of the situation, on the day of surrender, the Imperial Japanese Forces numbered 6,983,000. Of these, 2,576,085 were stationed on the home islands of Japan and the remainder were "spread in a great arc from Manchuria to the Solomons * * *." Although thousands of these Japanese were in the status of prisoners of war, having been taken into U.S. custody before the cessa-

¹⁰⁴ Letter, Col. Arthur B. Welsh, MC, Acting Surgeon, Headquarters, U.S. Army Forces, Middle Pacific, to The Surgeon General, 31 July 1945, subject: Filariasis in Okinawan Prisoners of War, with 1st indorsement, Office of The Surgeon General, to Assistant Chief of Staff, G-1, 14 Aug. 1945.

¹⁰⁵ Willoughby, Charles A., and Chamberlain, John: MacArthur, 1941-1951. New York: McGraw Hill Book Co., Inc., 1954, pp. 309-310.

tion of hostilities, they and the forces on the home islands rapidly passed into the process of demobilization and repatriation. The landing of U.S. Army forces on Atsugi Airfield put in motion General MacArthur's uncontested occupation of Japan. "By the tactful utilization and suitable modification of existing Japanese government organs [including military ministries and the high command], all Japanese armed forces in the homeland were physically disarmed by early December 1945. * * * By the middle of 1946, a total of about 2,170,000 Army and Navy personnel had been demobilized in the homeland and 3,880,000 [had been demobilized] on repatriation from overseas." By the return of Japanese military personnel to civilian status, the enormous task of administering them as prisoners of war was obviated. There was no longer any need in Japan for a special program of preventive medicine for enemy prisoners of war. The problems and needs in that field were handled by the Public Health and Welfare Section, General Headquarters, Supreme Commander for the Allied Powers. As consideration of those affairs is properly placed in Volume VIII of the preventive medicine history series (Civil Affairs-Military Government Public Health Activities), it is not discussed in this chapter.

In his final evaluations of activities in the Pacific areas, the Provost Marshal made the following comments:

In general, prisoner of war camps were operated in the same manner as other military establishments. * * * Generally, sanitary conditions and health of prisoners were excellent. However, due to the physical conditions of many prisoners upon capture or surrender their hospitalization at times developed into major problems. Medical facilities were provided at all camps, but because of the advanced conditions of wounds, malnutrition and tropical diseases, favorable reaction to treatment was not always possible and a high death rate resulted. Prisoners who survived after three weeks of capture rapidly recovered from their conditions.¹⁰⁶

During the period covered in this narrative [April 1945-December 1946], approximately 270,000 prisoners of war were taken into custody, processed, and repatriated. * * * During the International Prisoner of War Committee meeting at Geneva early in 1947, there was no adverse comment of criticism or censure of this theater in the handling of prisoners of war during World War II.¹⁰⁷

CONTINENTAL UNITED STATES

Camps for Enemy Prisoners of War

To relieve the theaters of operations of a part of the burden of custody of enemy prisoners of war, and to provide a supplemental labor force, decision was made by highest authority, early in 1942, to intern within the continental United States numbers of captured German, Italian, and Japanese soldiers, including military medical personnel and other specialists, who would be utilized for work under the general supervision of the

¹⁰⁶ The Provost Marshal's History, 1941-47. Campaigns in the Pacific. Chapter VI, Prisoner of War Operations, pp. 21-22.

¹⁰⁷ Administrative History, Office of the Chief Provost Marshal, General Headquarters, U.S. Army Forces in the Pacific, 6 Apr. 1945 to 31 Dec. 1946, p. 27. [Official record.]

War Department. The importation of the prisoners began in May 1942. During that year, the numbers were small. They rose to a total peak of 425,871 in May 1945, of which 371,683 were German, 50,273 Italian, and 3,915 Japanese. While the German component decreased steadily in the succeeding months, entries and discharges affected the others differently. The Italian peak of 50,571 had been reached in February 1945, and the largest number of Japanese, 5,413, was attained in August 1945. After these peak dates, the number of prisoners of war interned in the United States decreased by discharge and repatriation until 30 June 1946, when the only ones remaining were 141 German, 20 Italian, and 1 Japanese serving sentences in U.S. penal institutions.

For the accommodation, care, and guarding of these prisoners, there were, by April 1945, 150 base camps located at or near Army posts, and 340 branch camps—all located in various sections of the United States. The camps varied in capacity from 250 to 3,000 men and served military, agricultural, and industrial needs.

The operation was unprecedented. The problems were new and urgent, and there was no previous experience upon which to draw for their solution. Never before had the United States brought prisoners of war in such numbers into its own territory. Never before in the history of warfare had prisoners been transported in such numbers across such long distances, by sea and air, to the homeland of a nation which was waging a vast war in foreign lands. The operation involved almost every main division and service under the War Department and Army organizations, at home and overseas. As it had public, political, economic, legal, financial, ethical, medical, national, and international aspects, it involved most of the departments and offices of the U.S. Government and a number of State governments. Even a simple listing of these relationships would exceed the scope of this chapter. Therefore, recourse must be made to other writings on the subject. For comprehensive accounts which, however, contain little about preventive medicine, the reader is referred to other sources.¹⁰⁸

Selected Features of Administration

All the camps were under U.S. Army authority and were administered through various Army organizations, such as service commands; posts, camps, and stations; hospitals; and miscellaneous military units. There were appropriate channels of communication to the Office of The Provost Marshal General, the Offices of the Chiefs of Technical Services, and finally

¹⁰⁸ (1) Lewis, George G., and Mewha, John: *History of Prisoner of War Utilization by the United States Army, 1776-1945*. Department of the Army Pamphlet No. 20-213, 24 June 1955. (2) Mason, John Brown: *German Prisoners of War in the United States*. *Am. J. of International Law* 39: 198-215, 1945. (3) Report No. 1992, *Investigations of the National War Effort*, Committee on Military Affairs, House of Representatives, 78th Congress, 2d Session, 30 November 1944. Washington: U.S. Government Printing Office, 1944. (4) *Historical Monograph, Prisoner of War Operations Division*, Office of The Provost Marshal General, 1945. [Official record.] (5) Juchli, Rene H.: *Record of Events in the Treatment of Prisoners of War, World War II*, September 1945. [Official record.]

to the Headquarters of the Army Service Forces and the War Department, especially the Office of the Assistant Chief of Staff for Personnel, G-1.

When medical affairs required central direction, they were handled in various divisions of the Surgeon General's Office. Those divisions most directly concerned were Preventive Medicine, Operations, Supply, and Hospitalization. Although no single division in the Office of The Surgeon General was charged with overall responsibility for this operation, a specially created Prisoner of War Liaison Unit dealt broadly with many medical matters relating to inspections, sanitary supervision, repatriation, and the activities of the Mixed Medical Commissions. This unit, established on 16 July 1943 under the Operations Service, provided for liaison between the Office of The Surgeon General and the Office of The Provost Marshal General. Later, when it was located in the Office of The Provost Marshal General, it was named the Medical Liaison Branch. The unit consisted of a chief (Lt. Col. Rene H. Juchli, MC), an executive officer, a medical certifying officer, and U.S. members of the Mixed Medical Commissions. Its service was beneficial and brilliant.

The administrative and professional arrangements included extensive provisions for hospitalization.¹⁰⁹ Medical and surgical care was provided in abundance in dispensaries and in hospitals of various types and sizes, staffed by both U.S. Army doctors, nurses, technicians, and attendants, and protected medical personnel drawn from Italian and German prisoners of war. In addition to the customary functions of hospitalization, these arrangements played an important role in preventive medicine by providing for diagnostic studies, isolation of patients with infectious diseases, and by curing the sick, thus through therapy preventing the spread of communicable disease.

Control of Communicable Diseases

Commanding officers of prisoner-of-war camps in the United States were charged with initiating and enforcing all sanitary and preventive measures necessary to protect and safeguard the health of prisoners of war, the attending military personnel, and the surrounding civilian population. Preventive medicine for enemy prisoners of war interned in the United States included attention to all the features specified in the Geneva Convention of 27 July 1929, and the implementing War Department circulars, technical manuals, and Army regulations that have been referred to and summarized in the first portions of this chapter. In accordance, however, with the ordinary conception of preventive medicine, the chief emphasis was placed upon the control of communicable diseases among the prisoners. There were four objectives:

¹⁰⁹ (1) McGibony, James T.: *Hospitalization, Evacuation and Disposition of Prisoner of War Patients in the United States*, 1946. [Official record.] (2) Smith, Clarence McKittrick: *The Medical Department: Hospitalization and Evacuation, Zone of the Interior. United States Army in World War II. The Technical Services*. Washington: U.S. Government Printing Office, 1956.

1. Prevention of the introduction of communicable disease into the United States by infected prisoners of war.
2. Protection of persons having contact with prisoners directly or indirectly in communities adjacent to their camps.
3. Protection and maintenance of the health of the prisoners.
4. Prevention of transmission of infectious disease abroad by repatriated prisoners.

Although these objectives overlap somewhat, to the extent that the accomplishment of one might assist the attainment of another, examples of several of the activities will be presented briefly.

The communicable diseases against which special measures were taken to prevent their introduction into the United States by prisoners of war were specified in the quarantine regulations of the U.S. Public Health Service and the policies promulgated in the Army Foreign Quarantine Program,¹¹⁰ as developed in the Quarantine Branch, Preventive Medicine Service, Surgeon General's Office. Among these, smallpox, malaria, filariasis, schistosomiasis, the typhus fevers, and enteric infections (especially the dysenteries), were considered to be the most important. Yellow fever, plague, cholera, and leprosy were regarded as of secondary importance.

The first guard was raised, of course, by medical inspection of prisoners of war at the time of their embarkation abroad and at the ports of debarkation in the United States. If found to have suspicious illness, the affected prisoner was isolated in a hospital.

Although there was a requirement that prisoners should be deloused before shipment, the rule was often not observed. Many prisoners were found to be infested with lice when they arrived at U.S. ports. All prisoners and their effects, therefore, were disinfested at the port of debarkation. In 1942-43, methyl bromide gas liberated in special wooden chambers was used for the disinfestation of clothing and other articles. The early apparatus, however, was defective, and steam treatment was employed instead.¹¹¹ Later, DDT insecticide powder was dusted on clothing, as on persons, to get rid of lice. By repeated applications of DDT insecticide powder, lousiness of prisoners of war in the camps was kept at a low incidence. Eleven cases of epidemic typhus developed in newly received prisoners, but no spread occurred; and there were no outbreaks of fleaborne endemic typhus. Four prisoners of war were found to have leprosy.

At ports of debarkation, prisoners of war were vaccinated against smallpox and injected with typhoid-paratyphoid vaccine.

The threat of the introduction of filariasis into Hawaii and the United States by Japanese prisoners of war from Okinawa has been discussed earlier (p. 410). The risk was obviated by stopping the importation of

¹¹⁰ Knies, Philip T.: Foreign Quarantine. In Medical Department, United States Army. Preventive Medicine in World War II. Volume II. Environmental Hygiene. Washington: U.S. Government Printing Office, 1955, pp. 271-324.

¹¹¹ Wheeler, William Reginald: The Road to Victory. A History of Hampton Roads Port of Embarkation in World War II. New Haven: Yale University Press, 1946, 2 vols.

infected prisoners and by deportation to Pacific areas of endemic filariasis in prisoners found by blood examinations to be harboring microfilariae. No known spread of filariasis from this source occurred in either Hawaii or the United States.

Many Italian and German prisoners of war, and numerous Japanese, were found to be infected with malarial parasites. As the Japanese were interned in Wisconsin and other areas that were free from anopheline vectors, they were not a malarial danger. Thousands of Italians and Germans, however, infected with malaria, were interned in camps in the Southern States, in locations in which they could be sources of spread of the infection to the extra-cantonment populations. This danger, recognized in 1943, was the subject of a memorandum issued from Headquarters, Army Service Forces, on the recommendation of the Preventive Medicine Service.¹¹²

Col. William A. Hardenbergh, SnC,¹¹³ Chief, Sanitary Engineering Division, Preventive Medicine Service, has published a succinct statement of the measures taken to prevent the spread of malaria from camps in which malarial prisoners of war captured in North Africa, Sicily, and Italy, were held. He wrote, as follows:

* * * When these prisoners were established in branch camps, the dual problem arose of protecting both the local populations and the prisoners against malaria. Because branch camps were often established on short notice, perhaps in the middle of the mosquito season, and sometimes in highly malarious areas, it was not considered feasible or possible to conduct mosquito control measures. * * * Therefore special emphasis was placed on surveys of proposed campsites to avoid the most unfavorable locations, and on strict enforcement of malaria discipline among prisoners.

Details of the numerous, standard, control measures are given in the remainder of Colonel Hardenbergh's section on "Prisoners of War" in the cited publication.

Examples of special efforts to protect prisoners of war from infections impinging upon them from the external environment in one situation and from the internal environment in another are the occurrence of coccidioidomycosis in the prisoner-of-war camp at Florence, Ariz., and at the prisoner-of-war base, Camp Cooke, Calif., and the presence of carriers of dysentery bacilli among German prisoners of war at Camp Hood, Tex. In both instances, after reports had been received in the Preventive Medicine Service, special investigations were made and control measures instituted through the Army Epidemiological Board. The problems of the recognition and control of coccidioidomycosis, coming from the external environment of the prisoner-of-war camps, were dealt with effectively by Dr. Charles

¹¹² War Department, Headquarters, Army Service Forces, Memorandum No. S40-10-43, Malaria Among Prisoners of War, 19 June 1943.

¹¹³ Hardenbergh, William A.: Control of Insects. In Medical Department, United States Army. Preventive Medicine in World War II. Volume II. Environmental Hygiene. Washington: U.S. Government Printing Office, 1955, pp. 179-232, esp. p. 200.

Edward Smith,¹¹⁴ Director of the Commission on Epidemiological Survey. The problems of recognition of dysentery carriers and of the control of outbreaks of bacillary dysentery, spread in an internal environment by infected prisoners, were worked out well by Dr. Carl TenBroeck¹¹⁵ of the Commission on Tropical Diseases.

For the prevention of the transmission of communicable diseases by repatriates returning to their homes, every effort was made to be sure that the individuals had clean bills of health, or if ill, as possibly with tuberculosis, were placed under hygienic control.

Food and Nutrition

Some prisoners of war interned in the United States complained about their food, as any soldier would, and as foreigners are apt to do because even good alien food may not be acceptable to their tastes. These complaints, however, were not serious and did not indicate nutritional deficiencies. Reported nutritional surveys were made, particularly during 1945, at the instigation of The Surgeon General, The Provost Marshal General, and The Quartermaster General, to ascertain whether the program for feeding prisoners of war was sound. In general, it was found that approved allowances provided balanced diets having caloric values ranging from 2,800 calories for prisoners engaged in sedentary activities to 4,300 calories for maximum labor. This was a satisfactory feeding regime. Indeed, the feeding of interned prisoners of war, together with their housing and provision for their other needs, was generally regarded as a credit to the good name of the United States.¹¹⁶

Health of Prisoners of War in the United States

During 1945, the typical year, the health of prisoners of war in camps in the United States was quite as good, and sometimes better, than that of U.S. Army personnel in the same region. For all diseases, the rate for U.S. Army troops was 563 per 1,000 per annum and 480 for prisoners of war. The incidence of respiratory diseases among prisoners was less than among U.S. Army troops. Injury admissions for prisoners were almost 50 percent higher than those for U.S. troops, apparently due to work details of prisoners involving greater exposure to relatively minor injuries as well as very vigorous participation in athletics. On the other hand, "death rates for prisoners was less than a third of the corresponding rates for U.S. troops. However, about three-quarters of the deaths among U.S. Army troops were

¹¹⁴ Smith, Charles Edward: *Coccidioidomycosis*. In *Medical United States Army. Preventive Medicine in World War II. Volume IV. Communicable Diseases Transmitted Chiefly Through Respiratory and Alimentary Tracts*. Washington: U.S. Government Printing Office, 1958, pp. 285-316.

¹¹⁵ TenBroeck, Carl: *Report on Dysentery Carriers Among German Prisoners*. The Rockefeller Institute for Medical Research, Princeton, N.J., 10 Jan 1944. [Official record.]

¹¹⁶ Annual Report, Preventive Medicine Service, Office of The Surgeon General, for Fiscal Year 1945, section XIII, Nutrition Division.

the result of aviation and automobile accidents, hazards to which prisoners are obviously not exposed."¹¹⁷

CONCLUSION

The foregoing pages have presented an account of preventive medicine for enemy prisoners of war captured by U.S. Army forces in each of the main theaters or areas during World War II. The extraordinary events of the war were unprecedented in the experience of those forces. In the handling of prisoners of war and related groups, masses of humanity and swiftness of developments were unanticipated determinants of conditions and problems. In this chapter, the attempt has been made to describe the resultant situations, and to analyze and evaluate them, with special reference to old and novel features of preventive medicine.

In addition to the hundreds of thousands of enemy prisoners of war in U.S. custody in 1945, there were more hundreds of thousands of persons in states of destitution and in need of care by the military in the European theater. These people were recovered Allied military personnel, displaced persons, and refugees. In attempting to return them to their homes or countries, all of these persons had to be moved on foot or transported in vehicles, fed, sheltered, supervised medically, and controlled hygienically, to whatever extent was possible. These groups of people added greatly to the burdens and complexities of the task that had to be performed by the victorious troops—still fighting during part of the time. Although the problems of handling these groups were similar to those of handling enemy prisoners of war, and were solved by applying similar principles, they were considered only secondarily in this chapter.

It was the intention of the U.S. custodians of captured enemy military personnel to live up to the humane, mutually advantageous, and legal provisions of the Geneva Conventions of 1929. In large measure, this was done. Often, however, circumstances made observance impossible. Occasionally, the requirements and spirit of the two conventions were willfully violated or neglected through ignorance or carelessness. Enormous problems had to be solved as quickly as possible. In the midst of devastation and disorder resulting from swiftly evolving continental campaigns and from vast battles whose compressive power herded together populations of captives, the burdens had to be carried by organizations that lacked personnel, performed in confusion, and were impeded by shortages of transportation, supplies, and facilities. Indeed, the Geneva Convention itself allows for such derogations as might be rendered inevitable by the conditions of capture, and commentators have concurred in the view that impossibility of performance is an acceptable excuse for noncompliance.

¹¹⁷ (1) Monthly Progress Report, Army Service Forces, War Department, 28 Feb. 1945, Section 7: Health, p. 15. (2) Health of Prisoners of War. Army M. Bull. No. 88, pp. 61-62, May 1945.

Advance planning was deficient. This was largely due to inexperience, lack of foresight, and to the occurrence of unanticipated situations which showed that many of the untried provisions of the Geneva Prisoners of War Convention of 1929 were not applicable to the unprecedented developments that erupted during the years 1942-45. Although good instructions were issued at the start, they were slow in getting to the front, and many had to be revised or supplemented as the war progressed.

Considerable morbidity and mortality, discomfort and misery, afflicted the hordes of captives crowded in enclosures. But no serious epidemics of disease occurred, except the ever-present diarrheas and dysenteries, which were spread and intensified by conditions in the prison camps. The dreadful state of affairs in a number of the enemy prisoner-of-war enclosures along the Rhine were not wittingly devised by the captors; they were forced into occurrence by the enormous successes of the Armies. This was so particularly during the last months of the war in the European theater where forces under the command of General Eisenhower were reaching the objective, which had been given him by the Combined Chiefs of Staff on 12 February 1944, to "enter the continent of Europe and, in conjunction with the other United Nations, undertake operations aimed at the heart of Germany and the destruction of her armed forces."

CHAPTER VII

Medical Laboratories

Gustave J. Dammin, M.D., and Elliott S. A. Robinson, M.D.¹

HISTORICAL NOTE

The history of the Army's medical laboratories is unique and important because in its unfolding one finds the origins of some of this country's major achievements in clinical, research, and public health laboratory medicine. A broad scope for Army laboratory medicine was established on 15 January 1926, when the mission of the Army Medical Department was defined in Army Regulations No. 40-5, a form which it retained throughout World War II. These regulations state:

The mission of the Medical Department is the conservation of man power—the preservation of the strength of the military forces. This is accomplished by the selection and enrollment for military service, through properly conducted physical examinations, of only those men physically fit for the performance of the duties to devolve upon them, by keeping such personnel in good physical condition through the application of modern principles of preventive medicine, and in furnishing those who do become disabled with such aid in the form of evacuation and hospitalization facilities as will speedily restore them to health and fighting efficiency.

Among the general functions assigned to the Medical Department in these regulations were “the preservation of health and the prevention of disease among personnel subject to military control, including the direction and execution of measures of public health among the inhabitants of occupied territories.”

Prevention of disease and injury as an important element of the Medical Department's mission was restated by Brig. Gen. Hugh J. Morgan, formerly chief of the Medical Consultants Division, SGO (Surgeon General's Office), as follows:²

The mission of the Medical Department of the Army in time of war is to prevent disease and injury and to provide optimum treatment for them when they occur, to the end of maintaining the lowest noneffective rate possible.

¹ The first draft of a portion of this chapter was written by Dr. Elliott S. A. Robinson, who as lieutenant colonel (later colonel) in the Medical Corps, AUS, had been in charge of the Laboratories Branch or Division in the Preventive Medicine Service, Surgeon General's Office, from March 1942 to November 1944. In 1957, illness, which proved fatal, forced Dr. Robinson to relinquish the preparation of the text. The work was then taken up by Dr. Francis E. Council. In 1962, at the request of the Advisory Editorial Board and the Editor in Chief, The Historical Unit, Dr. Gustave J. Dammin consented to write a new chapter. As major and lieutenant colonel in the Medical Corps, AUS, Dr. Dammin served as director of the Laboratories Division from 29 December 1944 to 15 April 1946. In preparing this chapter, he has utilized the aforementioned drafts and various afteraction reports, has added much material, and has drawn upon his extensive experience in laboratory activities during World War II and in his civilian scientific career.—E. C. H.

² Medical Department, United States Army. *Internal Medicine in World War II. Volume I. Activities of Medical Consultants.* Washington: U.S. Government Printing Office, 1961, p. xix.

These statements define the great breadth of medicine that the Department's activities were expected to encompass. The mention of preventive medicine with emphasis equal to that given to clinical medicine explains the manifold responsibilities assigned to the hospital and other medical laboratories which served in the Zone of Interior and overseas during World War II.

It was not until December 1918 that a Laboratory Division appeared in the organizational chart of the Surgeon General's Office (chart 8). Activities under this division numbered four: (1) Laboratories, (2) Infectious Diseases, (3) Venereal Diseases, and (4) Medical Museum. So prominent a position in the administrative structure of the Surgeon General's Office was not achieved again until 1944.

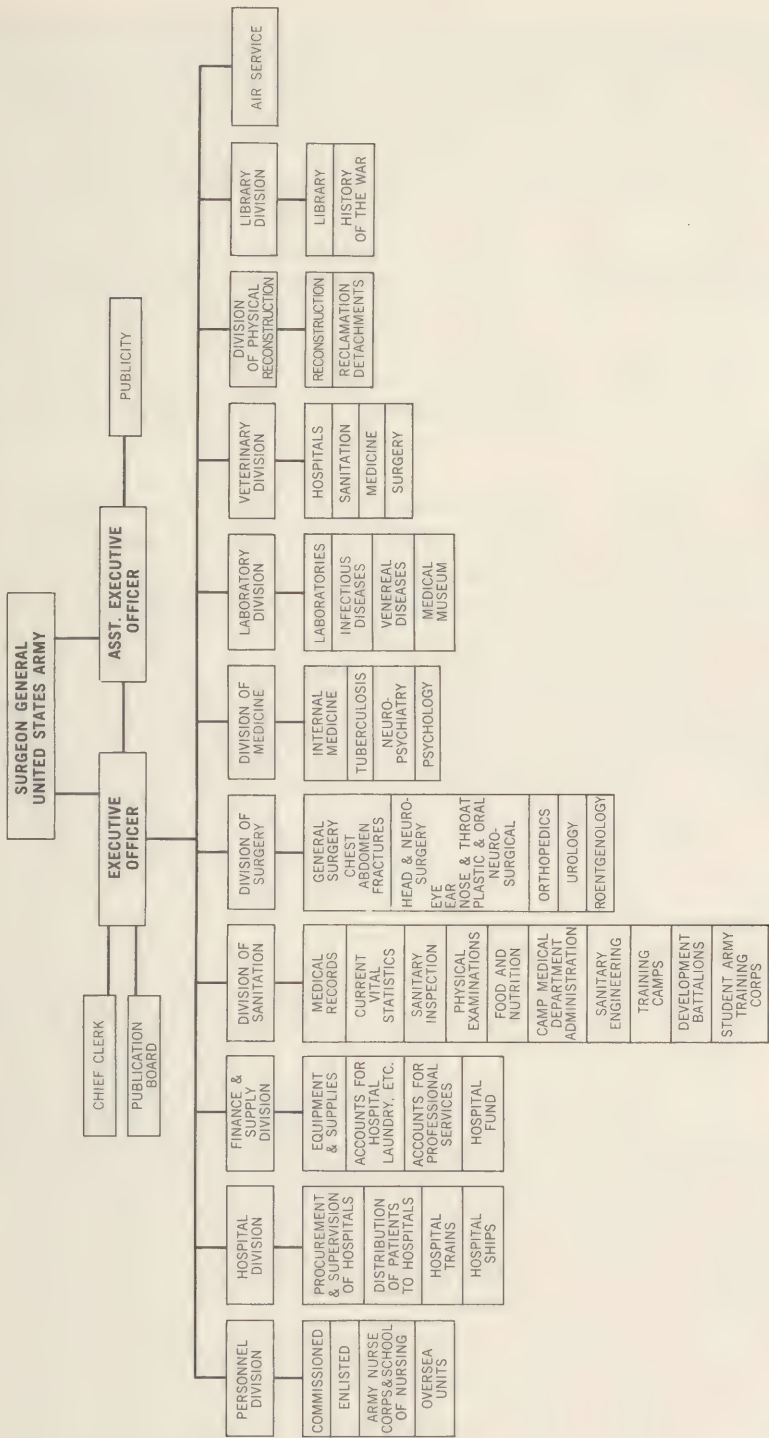
Organizational charts in use after World War I show that soon after the war the medical laboratories were given a subdivision status in the Division of Sanitation of the Surgeon General's Office. Later, in a proposed wartime organization chart dated 11 April 1925, the Division of Sanitation was replaced by a Professional Service Division which had a Preventive Medicine Branch with "Laboratories" as one of its subunits. A comparable position for the medical laboratories appears in an organizational chart prepared in 1940, which shows this as an activity under the supervision of the Preventive Medicine Subdivision. In 1941, a Preventive Medicine Division was established with five subdivisions, one of which combined laboratories, sanitation, and hygiene.

Recognition of clinical pathology as a separate activity within an Army hospital occurred first during World War I, when three major services were established: (1) Surgery, (2) medicine, and (3) laboratory. Within a hospital, the laboratory was expected to serve also as a local or even regional public health laboratory. The laboratory service of a 500-bed hospital was responsible for histopathology, bacteriology, serology, chemistry, and mortuary. Public health laboratory work was done when requested by the command and as determined by the chief of the laboratory service. Particularly interesting is an account of the work done in the base hospital at Camp Grant, Ill., in 1917. The high caliber of the laboratory work is apparent from statements made by physicians when they began their service as medical officers at Camp Grant. They were astounded to find such excellence in the organization of, and equipment in, an Army medical laboratory. In this account, the superb quality of clinical microscopy is stressed and is described as being far advanced by comparison with medical laboratory practice in general.³

In September 1939, when President Franklin D. Roosevelt proclaimed the "limited national emergency," the Medical Department was operating seven general hospitals and 119 station hospitals. The five general hospitals in the United States were: Walter Reed, Washington, D.C., Army and Navy,

³ The Medical Department of the United States Army in the World War. Washington: Government Printing Office, 1923, vol. V, pp. 193-271.

CHART 8.—*Organization of the Surgeon General's Office, December 1918*



Source: The Medical Department of the United States Army in the World War. Washington: Government Printing Office, 1923, vol. I, p. 540.

Hot Springs, Ark., Fitzsimons, Denver, Colo., Letterman, San Francisco, Calif., and William Beaumont, El Paso, Tex. The remaining general hospitals were: Tripler, Oahu, Territory of Hawaii, and Sternberg, Manila, Philippine Islands. Of the 119 station hospitals, 104 were in the United States and Alaska, and the remainder were in the Philippines, Hawaii, Puerto Rico, and the Canal Zone. The Surgeon General had regarded the Army's hospitals as inadequate to meet even peacetime needs and had recommended, as early as 1934, their expansion and modernization. However, funds authorized by Congress were adequate only for maintenance of existing buildings. For this reason, the Army hospitals in 1939 were poorly suited to any increase in size or expansion. Similar recommendations to improve the hospital system were expressed in the annual reports of The Surgeon General for 1937, 1939, and 1940 and were presented before the Subcommittee of the Committee on Appropriations, House of Representatives, 76th Congress.

Unfortunately, reserve equipment which the Medical Department had on hand in September 1939 for possible expansion of hospitals was of 1918 vintage and lacked many essential items. Tables of organization and tables of basic allowances had not been changed since 1929, and the preparation of new equipment lists for them had just been initiated in January 1939.⁴ To close a widening gap rapidly, The Surgeon General proposed the organization of hospital units from the staffs of the medical school faculties, so-called affiliated units. As early as August 1939, the Secretary of War approved, in principle, The Surgeon General's plan to organize such affiliated units and to staff in this pattern 32 general, 17 evacuation, and 13 surgical hospitals. Full approval was given several months later. Among the earliest hospital units to be shipped overseas were these affiliated hospital units. Early in 1942, 12 were activated, and by 1 June of that year, six had departed for overseas duty.⁵

Many of the laboratory units and operations employed in World War II could trace their origins to World War I. For example, the central Medical Department laboratory of the American Expeditionary Forces at Dijon, France, was the predecessor of the medical general laboratory of World War II. This central laboratory of World War I had divisions of bacteriology, serology, pathologic anatomy, chemistry, and medical biology. The responsibilities of this laboratory, as outlined by Lt. Col. (later Col.) J. F. Siler, MC,⁶ became the mission for the medical general laboratory of World War II. In the laboratory at Dijon were officers who were to achieve great

⁴ Smith, Clarence McKittrick: *The Medical Department: Hospitalization and Evacuation, Zone of Interior. United States Army in World War II. The Technical Services.* Washington: U.S. Government Printing Office, 1956, p. 6.

⁵ (1) *Annual Report of The Surgeon General, U.S. Army.* Washington: U.S. Government Printing Office, 1940, pp. 176-178. (2) Smith, Clarence McKittrick: *The Medical Department: Hospitalization and Evacuation, Zone of Interior. United States Army in World War II. The Technical Services.* Washington: U.S. Government Printing Office, 1956, pp. 157, 158.

⁶ *The Medical Department of the United States Army in the World War.* Washington: U.S. Government Printing Office, 1927, vol. II, pp. 147-149.

prominence in American medicine. Among them, in addition to Colonel Siler, were Lt. Col. William J. Elser, MC, Maj. Ward J. McNeal, MC, Col. Richard P. Strong, MC, Maj. Phillip A. Shaffer, SnC, and Lt. Col. Walter B. Cannon, MC. Also working in the pathology laboratory at Dijon was 1st Lt. (later Col.) Frank B. Berry, MC, who, during World War II, was surgical consultant to the Seventh U.S. Army,⁷ and after the war, was Assistant Secretary of Defense (Health and Medical). In addition to laboratory work done at Dijon, extensive investigations of respiratory and other diseases were carried out in the field. Attached to the laboratory at Dijon was a museum and art section, from the Army Medical Museum, which was responsible for the collection of specimens for the museum and also for the illustration of surgical operations and war wounds. Technical instruction was given by the staff of this museum section in the collection and preservation of specimens. Valuable material on gas poisoning, gas gangrene, influenza, pneumonia, and typhoid fever, among other major medical problems, was collected for instructional and research purposes.

The historical account of the central Medical Department laboratory of the American Expeditionary Forces in Dijon includes mention also of the work of Dr. Hans Zinsser, Dr. Haven Emerson, and Dr. Harry Plotz, all destined to become important figures in American medical science.⁸

Just as the central Medical Department laboratory became a model for the successor medical general laboratory of World War II, so also was the Army laboratory of World War I the predecessor of the Medical Field Laboratory, Army or Communications Zone, of World War II. The Army laboratory of World War I had a base laboratory with mobile sections which used railroad cars and modified trucks as field laboratories.

Not only was the laboratory organization, as used in World War I, duplicated in great part in World War II, but many of the laboratory items as well found their places in the tables of supply and equipment used in World War II.

The hospital centers of World War I represented a forerunner of the hospital center plan used in World War II. They were comprised of base hospitals with as many as eight such hospitals in a center. Through a pooling of resources and a sharing of responsibilities, optimal use was made of specialized personnel and facilities. For example, one hospital laboratory would provide bacteriological services for the entire hospital center. At the end of 1918, there were more than 20 hospital centers. The number of pathologists needed to staff this enormous hospital system, which had grown so rapidly, was never met. At no time during the war was there a sufficient number of trained pathologists in the service. The same condition seems to

⁷ Berry, Frank F.: Seventh U.S. Army. In *Medical Department, United States Army. Surgery in World War II. Activities of Surgical Consultants. Volume I.* Washington: U.S. Government Printing Office, 1962, ch. XVIII.

⁸ The Medical Department of the United States Army in the World War. Washington: U.S. Government Printing Office, 1927, vol. II, pp. 157-165 and 203-211.

have existed in civil life, for it proved impossible to find a sufficient number of trained men.

Because many of the duties in the laboratory could be shared by Medical Corps and Sanitary Corps officers, shortages of Medical Corps laboratory officers were met in part by commissioning laboratory specialists into the Sanitary Corps. World War I records indicate that the importance of the Sanitary Corps in the medical laboratory was recognized fully. Many scientists skilled in bacteriology, biochemistry, and the other disciplines so essential to the Medical Department's program were commissioned directly into the Sanitary Corps or were assigned to laboratories as enlisted men. The degree to which their vital role was appreciated is indicated by their numbers in relation to the number of Medical Corps officers who served in the Medical Department. During the last year of World War I, there were on duty 945 Medical Corps officers, 405 Sanitary Corps officers, 398 technicians, and six contract surgeons. Of particular interest to pathologists is the mention of Dr. James Ewing as one of these contract surgeons. He later became professor of oncology at Cornell University Medical College, New York, N.Y.

Throughout the account of World War I, there is mention of the assistance given by the Rockefeller Institute for Medical Research through its laboratory training programs. Abundant assistance also came from other civilian laboratories and institutions of learning, particularly Yale University, which established an Army Laboratory School.⁹ Training in pathology was given at the Army Medical Museum; St. Elizabeths Hospital, Washington, D.C.; and the New Haven Hospital. Within the Army, officers and enlisted men received laboratory training at the Army medical schools located at Fort Leavenworth, Kans., Camp Devens, Mass., and Camp Greenleaf, Ga. During that time, there was published the important Medical War Manual No. 6, "Laboratory Methods of the United States Army."¹⁰ Authorized by the Secretary of War and under the supervision of The Surgeon General and the Council of National Defense, this manual was compiled by the Division of Infectious Diseases and Laboratories, in the Surgeon General's Office. Although its major contributors were members of the Surgeon General's staff, members of the Medical Reserve Corps also assisted by preparing some of the sections and by descriptions of special methods. The manual, destined for wide and continued acceptance in civilian as well as in military medicine, underwent revision and growth, the fifth edition being published in 1944 to fill a wartime need.¹¹

The Army Medical Museum, founded in 1862, has been mentioned earlier for its role in training and in the collection and illustration of material on diseases encountered in World War I. During the year ending in

⁹ The Medical Department of the United States Army in the World War. Washington: U.S. Government Printing Office, 1927, vol. VII, pp. 459-464.

¹⁰ Medical War Manual No. 6, Laboratory Methods of the United States Army. Philadelphia: Lea & Febiger, 1918.

¹¹ Simmons, James Stevens, and Gentzkow, Cleon J. (editors): Laboratory Methods of the United States Army, 5th ed. Philadelphia: Lea & Febiger, 1944.

April 1918, more than 13,000 pathological specimens were collected. This activity of the museum was one of many that were to become incorporated into the museum's mission in World War II.¹²

Other historical events deserve mention insofar as they provide the background and also the basis for important developments in Army laboratory medicine during World War II. It should be remembered that clinical pathology, as it is understood today, did not have its beginnings until the early years of this century. Bacteriology had been developing rapidly during the last decades of the 19th century with outstanding achievements identified with Army laboratories, but bacteriology did not become an integral part of hospital laboratory practice until well into the second decade of the 20th century. Clinical microscopy, with improved and simplified methods for examination of blood, urine, and spinal fluid, was still being developed and did not have wide use even at the beginning of World War I.

During World War I, the Army adopted and put into wide use many of the newly developed diagnostic procedures which were enlarging the field of clinical pathology. As newer procedures appeared, many were found useful in both clinical and public health laboratories. Routine tests for detecting infections not identifiable clinically, such as syphilis, represented a very important development. These became available during the second decade of the century, and soon after their introduction, the Army accelerated their use. Before long there were not only routine serologic tests for syphilis but also routine clinical chemistry, bacteriology, and microscopic examinations of the blood and urine. When epidemiological circumstances did suggest a particular problem, surveys for pathogenic bacteria in the throat and in the intestinal tract were carried out in the Army's laboratories in the Zone of Interior and overseas with the American Expeditionary Forces.

Logically, the development and adoption of laboratory tests for screening and survey purposes was undertaken by the Army because of its parallel concern with preventive and clinical medicine. As one reviews the Medical Department's installations and operations at camps, posts, and stations in the Zone of Interior and overseas, it is clear that the medical officer must be alert to opportunities to prevent disease at the same time that he is responsible for the treatment of disease. It should be apparent also that the prevention of disease represents a phase of his mission requiring support from many disciplines, not all of which are related directly to care of the patient. He needs assistance, for example, from the sanitary engineer, the entomologist, and the veterinarian. At the same time, as a clinician, he needs the bacteriologist, chemist, psychologist, nutritionist, and others.

No historical note on Army medicine, particularly laboratory medicine, would be complete without acknowledging the Army's indebtedness to Brig. Gen. George Miller Sternberg, who was The Surgeon General from 1893 to

¹² Henry, Robert S.: *The Armed Forces Institute of Pathology: Its First Century, 1862-1962*. Washington: U.S. Government Printing Office, 1964.

1902. He was an outstanding scientist of international renown and a major contributor to our knowledge of infectious disease. Among his achievements were the establishment of the Army Medical School and the organization of the Typhoid Board and the Yellow Fever Commission, both made famous by the work of Walter Reed. His biography is too well known to need recounting here. Highly appropriate to this chapter, however, is the following quotation of a tribute to him which emphasizes the laboratory aspects of his career.

To George M. Sternberg (1838–1915)—Pioneer American bacteriologist, who was Surgeon General of the United States Army during the last decade of the nineteenth century, and to the host of laboratory workers who, inspired by his zeal for scientific research, have since made such rich contributions to the prevention of disease among American troops and to the health and welfare of mankind.¹³

LABORATORIES DIVISION, PREVENTIVE MEDICINE SERVICE, SURGEON GENERAL'S OFFICE

Organization

The representation of preventive medicine in the Surgeon General's Office, as it obtained through 1944–45, was established on 1 January 1944. Office Order No. 4 of that office and date, provided for a Preventive Medicine Service as one of nine services under The Surgeon General. The chief of the service was Col. (later Brig. Gen.) James S. Simmons, MC. The deputy chief, Col. (later Brig. Gen.) Stanhope Bayne-Jones, MC, served also as director of the U.S.A. Typhus Commission and as administrator of the Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army (known also as the Army Epidemiological Board). The Laboratories Division became one of 10 divisions in the Preventive Medicine Service and remained so until the end of the war (chart 9).

A summary of the events which led to the establishment of the Laboratories Division, beginning with the proclamation of the limited national emergency, in September 1939, follows.

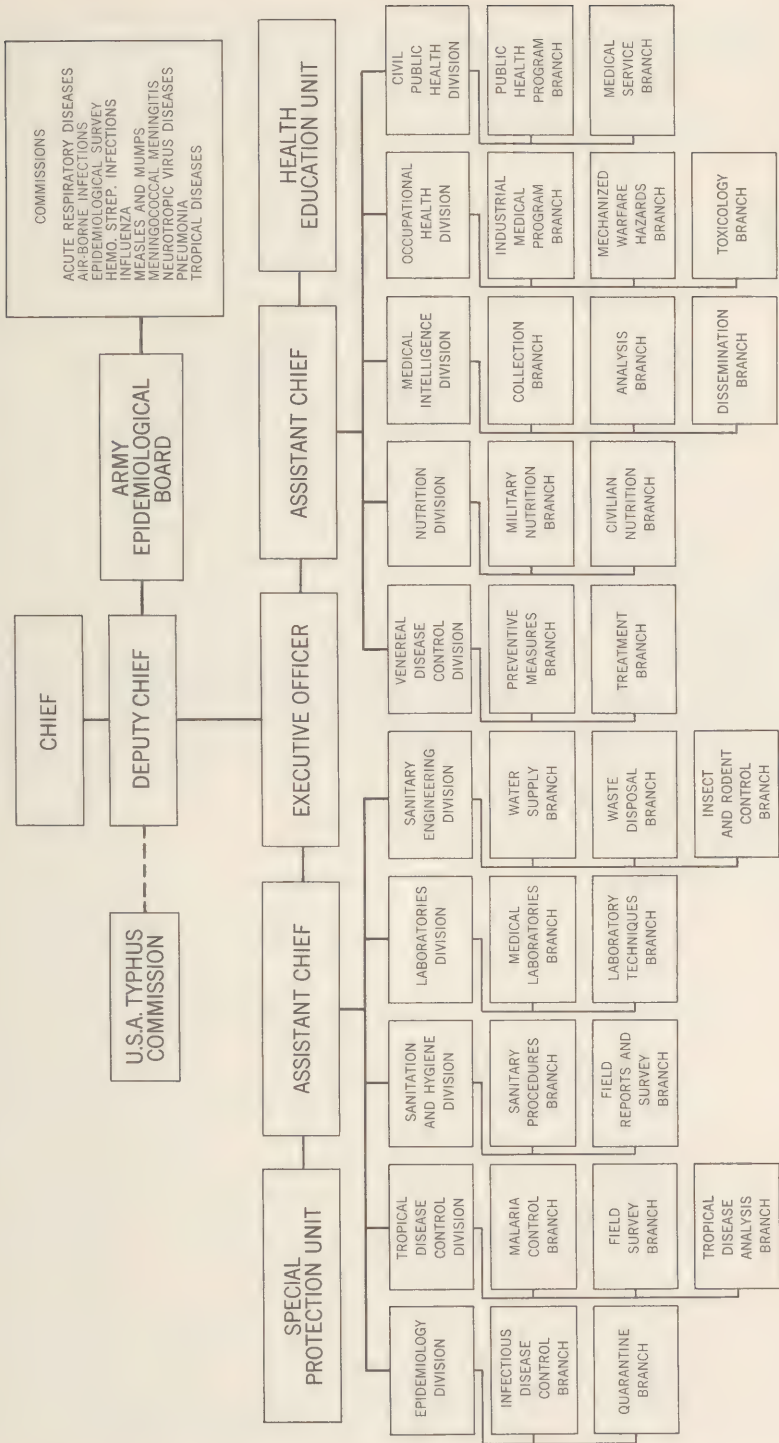
In early 1940, preventive medicine had the status of a subdivision in the Professional Service Division of the Surgeon General's Office. The Preventive Medicine Subdivision was placed under the supervision of Colonel Simmons. The four sections which comprised this subdivision were: (1) Sanitation, (2) Epidemiology and Control of Communicable Diseases, (3) Venereal Disease Control, and (4) Medical Laboratories.¹⁴ This subdivision was succeeded by the Preventive Medicine Division early in 1941.¹⁵ There were five subdivisions created at that time, one of which was the Sanitation, Hygiene, and Laboratories Subdivision (chart 10).

¹³ See footnote 11, p. 424.

¹⁴ Office Order No. 51, Office of The Surgeon General, 7 May 1940.

¹⁵ Office Order No. 87, Office of The Surgeon General, 18 Apr. 1941.

CHART 9.—Preventive Medicine Service, Surgeon General's Office, 6 January 1945



For a brief period in early 1942, preventive medicine had the status of a service, and laboratories had the status of a division of that service. However, in August 1942, preventive medicine was again designated a division and remained so until January 1944 when, as noted earlier, it was organized as a service with laboratories comprising one of its 10 divisions.

Irrespective of its position within the preventive medicine organization of the Surgeon General's Office, the unit that guided medical laboratory activities carried unusually broad responsibilities. How broad they were was not always apparent from the organizational charts. For example, one of the functions of the Laboratories Division related to the procurement, selection, assignment, training, and evaluation of Medical Corps and Sanitary Corps laboratory officers, a responsibility which one would regard as belonging primarily to the Personnel Service. As detailed later, many laboratory officers were needed, not only in the Medical Department's clinical and laboratory facilities, which were supporting troops directly, but also in many other activities, such as the Chemical Corps and Quartermaster Corps research and training installations. Because these activities were outside the Medical Department, and because many of them were classified, this facet of the operations of the Laboratories Division was unknown outside the Preventive Medicine Service. The varied needs for laboratory officers grew much more rapidly than did the supply, and this demand was but one of many which grew progressively. As a result, the Laboratories Division was relatively understaffed during the years of peak war activity.

The director of the Laboratories Division from March 1942 until November 1944 was Lt. Col. (later Col.) Elliott S. A. Robinson, MC. Colonel Robinson's long experience in laboratory work in the Massachusetts State Department of Public Health, as it related to preventive medicine and epidemiology, was reflected in his contribution to the development of the Laboratories Division and the pursuit of its mission. Maj. (later Lt. Col.) A. James French, MC, was assigned as assistant chief of the Laboratories Division from April 1942 until February 1944. His talents were needed in 1944 in the organization of the 19th Medical General Laboratory with which unit he served from the time of his departure from the Laboratories Division until the end of that laboratory's service in the Philippines in 1946. When Colonel Robinson became assistant chief of the Preventive Medicine Service in November 1944, he succeeded Col. Karl R. Lundeburg, MC, who departed for assignment with the U.S. Forces, India-Burma Theater, to head preventive medicine activities there. For about a month, Lt. Col. (later Col.) Arthur P. Long, MC, served as director of the Laboratories Division, following which he was assigned to the Epidemiology Division. Maj. Arthur Stull, SnC, was then appointed acting director of the Laboratories Division, in addition to his duty as chief of the Laboratory Techniques Branch of the division. Maj. (later Lt. Col.) Gustave

J. Dammin, MC, was assigned to the division and appointed as its director on 29 December 1944, following a tour of duty in the India-Burma Theater. At that time, Major Stull became assistant director of the division, and continued as chief of the Laboratory Techniques Branch, which positions he occupied until he departed in May 1945 for duty in the Pacific with the 19th Medical General Laboratory. Maj. Jack M. Evans, MC, chief of the other branch of the division, the Medical Laboratories Branch, became assistant director in June 1945 in addition to his other duties. Other personnel on duty in the division consisted of four civilian secretaries.

Mission and Functions

Even when laboratory activities were not identified as the responsibility of an independent office within the organizational pattern of preventive medicine, as was the case in early 1941, a broad mission was charged to the laboratory segment of the Sanitation, Hygiene, and Laboratories Subdivision. The mission of this subdivision with respect to laboratories was defined as follows: "Organization and coordination of the laboratory services required for the Army, including (1) diagnostic services for hospitals, and (2) epidemiological, sanitary, and supplemental services for corps areas and departments. Assistance in the location and procurement of commissioned, enlisted, and civilian personnel qualified in the various laboratory specialties, and recommendations on laboratory technique, reagents, equipment and supplies." At that time, Maj. (later Col.) William S. Stone, MC, was on the staff of the subdivision and was responsible for both sanitation and laboratory activities. The following year, independent status for laboratories was achieved in the form of the Laboratories Branch with Colonel Robinson as branch chief and a second full-time officer as assistant chief.¹⁶

The substance of the foregoing statement of mission was repeated periodically in official documents, such as office orders and annual reports. For the period upon which this chapter centers its interest, namely 1944-45, a comprehensive restatement of the mission of the Laboratories Division was made by the division director, Major Dammin, in his annual report for 1945, as follows: "The Laboratories Division, through the Chief, Preventive Medicine Service, advises The Surgeon General and other Divisions and Services under his jurisdiction, and establishes policies on matters pertaining to medical laboratory methods, equipment, supplies, personnel, organization, research and field investigations."¹⁷

It was apparent to the staff of the Laboratories Division, consisting of a director and two branch chiefs, that the aims of the division, as expressed in the mission, could be achieved best by adhering to the concept that the

¹⁶ Memorandum, Col. Stanhope Bayne-Jones, MC, for the Director, Fiscal Division, SGO, 22 Feb. 1943, subject: Report of Activities of the Preventive Medicine Division for 1942.

¹⁷ Annual Report, Laboratories Division, Preventive Medicine Service, Office of The Surgeon General, 1945.

proper utilization of a laboratory organization in a command demanded that the ranking laboratory officer be regarded as the laboratory consultant and also adviser on both clinical and public health laboratory matters. This use of laboratory officers was encouraged in official publications,¹⁸ but too often there was reluctance to adopt the practice. Where it was adopted, there was usually proper utilization of the command's laboratory organization. Simultaneously, this facilitated communication between the Laboratories Division and laboratories in a command since the division had to deal only with the command's laboratory consultant. Therefore, a major objective of visits by members of the Laboratories Division to the Zone of Interior and overseas commands became the adoption of the practice of having a command laboratory consultant. As detailed below, it was unfortunate that these efforts of the Laboratories Division were rewarded only in part, since those commands which did not establish laboratory consultants did not develop effective laboratory organizations.

With the establishment of a Laboratories Division, the mission was detailed further in accord with the responsibilities delegated to its two branches, the Medical Laboratories Branch and the Laboratory Techniques Branch.

The Medical Laboratories Branch reviewed and advised on the organization, administration, operation, personnel, supplies, equipment, and responsibilities of clinical and field laboratories in the Zone of Interior and overseas. The chief of the branch, as consultant to the Personnel Service on laboratory officer assignments, maintained classification, qualification, and assignment data on Medical Corps and Sanitary Corps laboratory officers. Through correspondence, visits, conferences, and reports, medical laboratory activities and problems were reviewed. Directives and administrative and technical materials were initiated in this branch, and, when necessary, were revised for publication in Army media.

In the Laboratory Techniques Branch, there was constant review and modification of medical laboratory methods used in Army hospitals and the medical laboratories in the field, both in the Zone of Interior and overseas. Laboratory methods, when introduced or modified, were coordinated with recommendations of the National Research Council, the Army Medical School, and the Army Medical Museum. Through visits to laboratory installations, reports, and correspondence, current technical methods were evaluated and data were obtained for revision when this was considered necessary. Publications on these matters were initiated, and revised when appropriate, by this branch.

¹⁸ (1) Letter, signed by order of The Surgeon General by Maj. David E. Liston, MC, Acting Executive Officer, 15 Aug. 1941, subject: The Development of Corps Area and Department Laboratories. (2) Army Regulations No. 40-305, 14 Nov. 1942. (3) War Department Field Manual 8-5, Medical Department Units in a Theater of Operations, May 1945, pp. 211-217.

Personnel

Sanitary Corps laboratory officers.—Among the major responsibilities of the Laboratory Division was that of providing advice and assistance on the procurement, selection, assignment, training, and evaluation of laboratory personnel. Constant attention was focused on the Sanitary Corps laboratory officers for reasons which will become apparent. During 1944–45, the division was required periodically to assist in meeting procurement objectives for Sanitary Corps laboratory officers. A call for 250 of these officers was authorized by the Secretary of War on 11 July 1944. Of the 250 Sanitary Corps laboratory officers required and later commissioned, 125 were bacteriologists, 100 were biochemists, and 25 were parasitologists. Of those reviewed as candidates for meeting this procurement objective, 50 percent had a bachelor's degree, 29 percent had a master's, and 21 percent had a doctoral degree.

As previously noted, the Laboratories Division was concerned also with laboratory personnel who served under auspices other than The Surgeon General. In this group were the laboratory officers assigned to medical field activities, such as malaria control and survey units which might be under the command of a field army or an overseas headquarters. Laboratory officers were provided also for research laboratories under such jurisdiction as the Armored Force (later the Armored Command and the Armored Center), the Chemical Corps, and the Quartermaster Corps.

In March 1945, the total strength of the Sanitary Corps was 2,796. Of this number, 1,301, or 46 percent, were laboratory officers, and over half of these were in overseas assignments. There were 765 bacteriologists, 386 biochemists, 125 parasitologists, and 25 serologists in the laboratory officer categories which were the responsibility of the Laboratories Division. In addition, there were laboratory officers who were commissioned in the WAC (Women's Army Corps). The procedure employed in requisitioning WAC officers for laboratory assignments was published in War Department Circular 344, dated 31 December 1943. During 1944, authorization was given to offer commissions in the Women's Army Corps to qualified enlisted women. Those WAC officers competent in medical laboratory work were detailed to the Sanitary Corps. Training courses for WAC officers so detailed were established at Billings General Hospital, Fort Benjamin Harrison, Indianapolis, Ind., and at the Fifth Service Command Laboratory.¹⁹

Another source of laboratory officers was the group of men who were commissioned upon completion of college Reserve Officers' Training Corps courses and who had taken college work in laboratory fields. In 1944, 64 officers in this category were added to the Sanitary Corps laboratory officer group.

¹⁹ Treadwell, Mattie E.: *The Women's Army Corps. United States Army in World War II. Special Studies.* Washington: U.S. Government Printing Office, 1953, p. 344.

Laboratory officers of the Sanitary Corps deserve particular mention and recognition for their contribution during the war. Utilization of these officers increased progressively, particularly when it was recognized that the number of Medical Corps laboratory officers with MOS (military occupational specialty) classification 3303, clinical pathologist, was far too small for the number of assignments to be filled. The number of Sanitary Corps officers on duty at the beginning of World War II was perhaps 10 percent of the number on duty during the peak year of the war, 1945.

Selection of candidates for commissions in the Sanitary Corps was difficult because of the few objective criteria which could be applied to determine competence. By comparison, the commissioning of physicians as Medical Corps laboratory officers was relatively simple, since there were records of performance in medical school, postgraduate training, State licensure, and hospital or medical school appointments. Prerequisites for Sanitary Corps commissions were issued on 7 January 1942 by the Surgeon General's Office. It soon became apparent that the initial set of qualifications had been established at too high a level, that the first procurement objective could not be met, and that modification of the prerequisites was necessary. Retained were the requirements for a bachelor's degree and 2 years of acceptable laboratory experience in one or several medical laboratory disciplines. Criteria concerning education, experience, and age were modified periodically, but because the number of Sanitary Corps laboratory specialists specified in successive procurement objectives could not be obtained, all laboratory specialists were placed in the "critical need" category in January 1943. Until July 1943, both Medical Corps and Sanitary Corps laboratory officers were classified as being in a "scarce category of specialized skills."

Recruiting for applicants for Sanitary Corps commissions took the form of communicating with scientific organizations, such as the Society of American Bacteriologists, the American Public Health Association, and the Registry of Medical Technologists. Letters outlining the opportunities offered by the Sanitary Corps were published in scientific journals.

Although the value of the Sanitary Corps laboratory officer to the medical laboratory organization became more widely accepted, it was apparent, too, that proper utilization of these officers was not universal. When inappropriate assignments were reported to the Laboratories Division, sometimes by the laboratory officer himself or by a regional clinical consultant, corrective action was taken to the extent possible. When staff members of the Laboratories Division visited installations, they inquired about the duties of Sanitary Corps laboratory officers. At times, a highly qualified laboratory officer was found in an assignment which was entirely administrative, sometimes in an activity that was entirely nonmedical. At other times, he would have so many additional duties, that there was little opportunity for him to serve as a laboratory officer.

It is understandable why the role of the Sanitary Corps laboratory

officer may not have been fully appreciated, since in many hospitals before the war, the laboratory staff consisted of one or several pathologists and a corps of technicians. Among the significant outgrowths of the war in the laboratory medicine field was the realization that (1) those scientists who served as Sanitary Corps laboratory officers were essential to a good hospital laboratory, (2) there were careers in hospital laboratory work for such scientists, and (3) the rapid and broad development of the field of clinical pathology in the Army during the war would increase enormously the opportunities for these medical laboratory scientists.

Medical Corps laboratory officers.—The extent to which the Medical Corps laboratory officer category had to be expanded during the war is emphasized best by noting that in 1941 there were 40 laboratory officers on active duty and that during 1945 there were over 1,200. Furthermore, most of those on duty in 1941 were Regular Army officers who had to be taken from laboratories and given administrative assignments in which they were even more critically needed. An increasing demand for Medical Corps officers qualified as histopathologists was foreseen early by Lt. Col. (later Col.) James E. Ash, MC, curator of the Army Medical Museum, and by Colonel Simmons. The museum developed a plan during 1941 which called for the establishment of "histopathologic centers" at selected hospitals. This represented a mechanism for making optimum use of the number of pathologists available and for giving the Army hospitals the best service possible. The plan was announced on 11 December 1941, by SGO Circular Letter No. 121, which discussed the facilities provided for histopathologic examination of tissues in the U.S. Army.

Each of the histopathologic centers was to have the services of at least two competent pathologists. One was always to be on call at the hospital, and the other was to assist, at least on a part-time basis, the laboratories of those hospitals under the jurisdiction of the histopathologic center. Unfortunately, the number of qualified pathologists available was too few even to staff the 19 centers established by Circular Letter No. 121, and its intent could be adhered to only in part. However, many centers with only a single senior pathologist were able to serve effectively on a regional basis. The timely and informative letter apprised the entire Medical Department of the important functions of the Army Medical Museum, and the manner in which it could assist the individual hospital and the newly established histopathologic centers. The letter was helpful also because it described for laboratory officers the services offered by the American Registry of Pathology and the Medical Illustration Service.

In early 1945, the Laboratories Division was planning to assign pathologists returning from the European theater to the histopathologic centers in the Zone of Interior in order to strengthen their staffs. However, needs for laboratory officers in the Pacific were increasing rapidly, and those returning from Europe were replacing pathologists in histopathologic centers and other hospitals who were being ordered to duty in the Pacific.

Shortages persisted, and optimum functioning of the histopathologic centers was never achieved.

Enlisted laboratory technicians.—From what has been related about the rapid expansion of hospital, service command, and other medical laboratories, it would be expected that the shortage of trained technicians would be even more acute than the shortage of Medical Corps and Sanitary Corps laboratory officers. Many enlisted men were being trained as technicians in the Army centers activated for this purpose. It became necessary, then, to recruit great numbers of civilian technicians. Technical Manual 8-227, "Methods for Laboratory Technicians," dated 17 October 1941, was very helpful not only for training purposes, but also for constant reference. Changes were made in the manual during the war (C1, 29 June 1942; C2, 1 April 1944), and a complete revision was released in October 1946, incorporating many of the methods developed during the war.

One of the problems encountered by the medical laboratory officer was traceable to the duties which his enlisted technicians were expected to perform outside the hospital or other medical laboratory. When a medical laboratory was a unit in a hospital, or on a military post (for example, a service command laboratory), the enlisted men of the laboratory were expected to share in the general activities of the parent installation. The command could choose to have enlisted laboratory technicians participate in all of the activities of its enlisted cadre and take technicians from the laboratory for long periods of field exercises, athletic events, guard duty, and the like. However, this seldom occurred when the hospital or post commander recognized that the laboratory had a large and continuing responsibility either to patients or to hospitals and other installations in a command. It was recognized that the enlisted medical laboratory technician, because of his specialized training, could not be replaced readily unless a trained substitute was available to fill his particular position. It devolved upon the chief of a laboratory to explain to a post commander the critical positions which some enlisted technicians occupied in a medical laboratory.

Evaluation.—Because of the important responsibilities incumbent upon the Laboratories Division for the assignment of laboratory officers, a continuing effort was made to maintain a current evaluation of each laboratory officer's performance. Periodic evaluation data were kept on each officer's file card in the division. Data were obtained through visits by members of the division to laboratory installations, through informal correspondence, and from reports of area medical consultants and the service command laboratories. Much more help from the commanding officers of the service command laboratories would have been welcome. Invaluable information was provided from those service commands in which the commanding officer was also the service command laboratory consultant.

The division sought constantly to strengthen the position of the service command laboratory in each command. Through personal visits to a com-

mand and by correspondence, a broader range of activity for a service command laboratory was urged because, in great part, the laboratory performance of hospitals in a command reflected the effort made by the service command laboratory. The service command laboratories were encouraged to send staff members to hospitals and also to bring hospital laboratory officers and technicians to the service command laboratory for training. In concept, the service command laboratories were to be responsible to, and responsive to, the service command headquarters and were to be located physically near them. They were to serve the service command surgeon and be on call to resolve laboratory problems in clinical medicine, preventive medicine, and public health.

One of the obstacles to the optimum functioning of these laboratories was embodied in ASF (Army Service Forces) Circular No. 13, dated 11 January 1945, which made the service command laboratory a component of the post on which the laboratory was situated. This gave the post commander authority to assign service command laboratory personnel to duties on the post as required. In addition, the laboratory might be deprived of its unit transportation and become dependent upon a post motor pool. Both officers and enlisted men were called upon for additional post duties. Furthermore, to compound the personnel problems in both the service command and the larger hospital laboratories, enlisted laboratory technicians, if fit for general service and needed for other assignments, were often removed completely from the laboratory. The intent of ASF Circular No. 193, dated 26 June 1944, was to halt release of laboratory personnel, either enlisted or civilian, until after fully qualified replacements had been assigned. Unfortunately, the replacements seldom were able to fill key positions satisfactorily.

The foregoing has been recounted because it may help to explain why some service command laboratories were limited in their ability to perform such tasks as the evaluation of laboratory officers in their commands; that is, the subsidiary position occupied by the laboratory on a post impaired its ability to communicate with other laboratories and officers in the command.

Consultants.—It is appropriate to mention here the assistance which came to the Laboratories Division from the reports of the clinical consultants in the service commands and the overseas theaters. It was gratifying to learn, for example, from the reports of Lt. Col. (later Col.) Walter Bauer, MC, Medical Consultant, Eighth Service Command, of the responsibility he took for ascertaining that laboratory work was kept at the optimum level and consistent with the capabilities of the laboratory serving a particular hospital. To support his active program, Colonel Bauer obtained financial assistance from the Rockefeller Foundation to underwrite the costs of clinicopathological conferences, library books, and the travel of civilian consultants.

Civilian consultants were welcomed not only in the service commands but also at the Army Medical Museum where they served tours of duty

which lasted for weeks or months, participating in service, training, and research programs. At the museum, the pathology consultants served as added staff members, sharing in the work entailed by the examination of almost innumerable specimens emanating from clinical and laboratory facilities in the many parts of the world where U.S. troops were stationed.

Another aspect of a laboratory commander's role as a laboratory consultant deserves mention. Occasionally, in a service command laboratory or other laboratory serving on a regional basis, a section chief, often a company-grade officer, found it expedient to communicate directly with the chief of a hospital laboratory service, often a field-grade officer, concerning such matters as the preparation and shipment of specimens or the diagnosis on a tissue specimen or culture. Differences arose when the section chief was not accepted as the representative of the laboratory commander, particularly when the laboratory commander was not regarded as the command's laboratory consultant. Because such a position for the laboratory commander facilitated the functioning of a laboratory organization in a command, surgeons were urged to name those in charge of their command laboratories as their laboratory consultants.

Support for better integration of medical laboratory work with other operations came also from surgical consultants. Col. Frank B. Berry, when Consultant in Surgery, Seventh U.S. Army, referring to his experience at Salerno and the invasion of southern France, remarked that consultants in all of the medical disciplines should, through representation at staff level, be apprised of major movements, such as landings, so that shiploading and other operations could be planned properly.²⁰ Comparable recommendations pertaining to Medical Department representation at staff level are noted frequently in the World War II Army records. They appear early, as in the final report of the Committee to Study the Medical Department (known as the Wadhams Committee), which was submitted to Gen. George C. Marshall, Army Chief of Staff, on 24 November 1942. This committee recommended: "The Surgeon General should be at staff level; surgeons in the Army Ground Forces, the Army Air Forces, oversea forces, and service command headquarters should also have staff position."²¹

When the opportunity presented itself during 1944, The Surgeon General, Maj. Gen. Norman T. Kirk, and his staff prepared a draft of a circular, for War Department release, which would reestablish a position on the War Department staff for The Surgeon General comparable to the one which he had enjoyed before the March 1942 reorganization of the Army. Further development of the draft circular and other negotiations to improve The Surgeon General's position were directed by Brig. Gen. Raymond W. Bliss, Assistant Surgeon General and director of the Control Division. The resultant War Department Circular No. 120, dated 18 April

²⁰ See footnote 7, p. 423.

²¹ Armfield, Blanche B.: Medical Department, United States Army. Organization and Administration in World War II. Washington: U.S. Government Printing Office, 1963, p. 176.

1945, did increase the stature of The Surgeon General and was a partial victory for him in that he was identified as the chief medical adviser for the Chief of Staff and the War Department, although he remained under the Commanding General, Army Service Forces. Before the circular was issued, the position of The Surgeon General, as viewed by the Secretary of War, was defined and strengthened in a statement released by the Secretary. The statement declared that The Surgeon General was to be the chief medical adviser to the Secretary of War on the care of the sick and wounded and the character of hospitalization, and stated further: "I wish it clearly understood that I am to have direct access to him and he to me on such matters whenever either of us deems it to be essential."²²

Higher status was achieved also for surgeons with the larger field units where the desirability of a staff position rather than a position under G-4 for the surgeon of an Army group was apparent. In his annual report for 1944, Lt. Col. (later Col.) Oscar S. Reeder, MC, described the handicaps inherent in his position as Surgeon, Sixth U.S. Army Group, under G-4. In May 1945, Colonel Reeder was placed on the special staff of the Sixth U.S. Army Group.²³

In 1945, in a critique based on his 3-year experience as medical consultant in the Eighth Service Command, Colonel Bauer offered three recommendations, the first of which called for Medical Department representation at Army staff level. The other recommendations pertained to (1) the desirability of developing distinct and different career patterns for those medical officers who aimed for achievement through command and staff positions, as distinguished from those whose competence and interests were in clinical and investigative work, and (2) the continuation of the consultant system as it was developed during World War II.²⁴

Finally, Lt. Gen. Leonard D. Heaton, The Surgeon General, explained in detail and defended the concept of having the surgeon of any command at staff level. In the foreword to "Organization and Administration in World War II," a volume in the history of the Medical Department, he described the importance of a staff position for the medical officer at every level of command as the single outstanding lesson learned by the Medical Department.²⁵

These statements about the need for a staff position for the surgeon of a command bear directly on the operation and utilization of a command's medical laboratory services. With the surgeon as a staff officer, the ranking

²² Armfield, Blanche B.: Medical Department, United States Army. *Organization and Administration in World War II*. Washington: U.S. Government Printing Office, 1963, pp. 237-241.

²³ Armfield, Blanche B.: Medical Department, United States Army. *Organization and Administration in World War II*. Washington: U.S. Government Printing Office, 1963, pp. 354-355.

²⁴ Morgan, Hugh J.: Service Commands. In Medical Department, United States Army. *Internal Medicine in World War II*. Volume I. Activities of Medical Consultants. Washington: U.S. Government Printing Office, 1961, ch. II.

²⁵ Armfield, Blanche B.: Medical Department, United States Army. *Organization and Administration in World War II*. Washington: U.S. Government Printing Office, 1963, pp. ix-xii.

laboratory officer's position as the command's laboratory consultant is enhanced immeasurably.

Equipment

Another important activity of the Laboratories Division consisted of participation in the review of (1) current equipment, (2) field reports on the performance of laboratory equipment, and (3) equipment lists for various types of laboratory units. These reviews brought the division into a close working relationship with the Technical Division, SGO, and the Medical Department Equipment Laboratory, in the Medical Field Service School at Carlisle Barracks, Pa. The years on which this chapter concentrates were busy years in the medical equipment field, because of the antiquated state of field equipment at the beginning of World War II, and because of the alarming gap between what was needed at once and what was available immediately.

Possibly because of insufficient funds and a shortage of trained personnel, there was little development of medical laboratory equipment following World War I. Unfortunately, the development of those items which could have had particular use in the field (namely, the laboratory truck and the laboratory chest) was not pursued. During the years between the wars, newer laboratory equipment and methods, as they were developed in various governmental and civilian laboratories, were regularly adopted by the Army's clinical and research laboratories. However, it would have been prudent to develop field laboratory equipment to the point of production and procurement so that in the event of an emergency, these military needs could have been met expeditiously.

An example of this is the laboratory truck. During World War I, laboratories were operated in railway cars, and some trucks were fitted out in overseas installations to operate as mobile laboratories. However, interest in the laboratory truck declined after World War I. It was not until 1939, when it was learned that some of the State health laboratories had mobile units, that the Army Medical School and the Medical Department Equipment Laboratory reviewed the possibility of developing a laboratory truck. The first unit planned and constructed was essentially an equipped trailer van. Delivered to the Army Medical School early in 1941, it was then transferred to the Fourth Service Command for field testing. Tests showed, however, that a trailer van was not feasible for field work because of its large outer size and still inadequate inner space for the types of work contemplated. It was concluded in the Preventive Medicine Division that it would be more practical to have laboratory chests and assemblies prepared for shipment as dictated by a particular mission, for example, dysentery and malaria. It was expected that most missions would be carried out with travel in smaller vehicles which had the advantages of greater mobility and a lower silhouette. This would assume operation out of a base

laboratory in which definitive laboratory work could be performed. This proposal received general acceptance, and laboratory truck development was suspended temporarily.

The case for a laboratory truck was revived by Lt. Col. (later Col.) Kenneth F. Ernst, MC, who commanded the 2d Medical Laboratory in the North African Campaign. The many hospitals served by this laboratory were widely dispersed, and support for them was provided best by the truck which Colonel Ernst equipped as a laboratory. He modified a small arms ordnance repair truck for use as a mobile laboratory. In July 1943, because of this experience, the Medical Department Equipment Laboratory was requested to develop a mobile medical laboratory of a single-unit type vehicle rather than a trailer type. A wide range of laboratory work was to be possible, and the design was to allow for flexibility. The development was pursued and, in June 1944, the Medical Department Technical Committee standardized the laboratory truck, with equipment lists having been reviewed and approved by the Laboratories Division. The truck was in production by early 1945, but none of those produced was shipped overseas during World War II. Laboratory trucks employed in the Italian Campaign also consisted of modified ordnance trucks.

It is quite clear that the nature of the operation and terrain were the determinants in the use of laboratory trucks. Apparently in North Africa, Italy, and the European theater, they proved useful. On the other hand, the operation in the Pacific did not lend itself to the use of these units.

Another item of constant concern for the Laboratories Division was the laboratory chest. Complaints from the field were numerous, most of them relating to breakage of items and an inability to repack the chest once its contents had been unpacked. There had been repeated modifications of the chest, but there was no overall analysis nor an effort to design it for particular types of laboratory work. For this reason, functional packing of the chest was never developed during the war. Even at war's end, complaints and suggestions continued to be referred to the Laboratories Division. By this time, the division had learned how much effort the German Army had put into its medical laboratory assemblies. Each hand-carry assembly was designed for the work of a particular unit of the laboratory; for example, clinical microscopy, chemistry, bacteriology, and so forth. When opened, the assemblies would become laboratory work areas. Several of the German assemblies were examined by the staff of the Laboratories Division, following which it was recommended to the Medical Department Equipment Laboratory that the assemblies be used as models for the further development of our own laboratory chests.

Although the possibility of developing a portable folding field microscope recurred periodically, such an item was never standardized. German and Japanese models were examined in the Laboratories Division and reviewed with the staffs at the Army Medical School and the Army Institute of Pathology. The consensus was that this type of microscope would have

limited use and that it could not be the only type available in field installations where prolonged use of the microscope was necessary. This would apply particularly to those laboratories whose major activities included parasitology and histopathology. During the postwar period, an English model compact-type microscope was tested under field conditions which demanded prolonged use of the instrument. Under these circumstances, this miniature microscope did not meet requirements. As of this writing (1965), a standard-size microscope contained in an 8-pound pack is being developed for use by the United States Strategic Army Corps Forces.²⁶

The laboratory balance which was to be developed specifically for the laboratory chest was still in the development stage at the end of World War II. Subsequently, this project was reviewed by triservice committees and considered inappropriate for further development.

The field item which was to serve as both sterilizer and laboratory autoclave reached the final stage of development in late 1945 at the Medical Department Equipment Laboratory, where it was identified as item T-59, autoclave, laboratory, horizontal. Further use of this field item was not explored when the Medical Department Equipment Laboratory terminated its activities at Carlisle Barracks.

The variety of laboratory tests required and developed showed a progressive increase throughout World War II. The eager clinician was anxious to employ the newer tests, and the alert laboratory officer was equally anxious to introduce them into his laboratory. However, the enthusiasm of the laboratory officer to expand the scope and facilities of his laboratory occasionally ran counter to the mission of his hospital. For example, station hospitals which were supported according to a regional plan by a general hospital, a service command, a medical general, or a medical field laboratory, were expected to perform only the simpler biochemical and bacteriological tests. When station hospitals, because of location, had to be more self-sustaining, they were permitted a wider range of laboratory work. Such eventualities were recognized by the Laboratories Division, when in January 1945, its staff developed and promulgated War Department Technical Bulletin 135, "Function and Scope of Medical Department Laboratories."

Listed in Technical Bulletin 135 were those tests which could be conducted under "normal" conditions by general, regional, station, evacuation, field, and other hospitals, dispensaries, infirmaries, and other laboratories. Conditions were not "normal" when a station, evacuation, or field hospital was serving on an area or regional basis and could not be supported readily by a larger laboratory installation. When they served in this capacity, such hospital laboratories were authorized additional personnel, equipment, and supplies.

²⁶ Personal communication, Assistant, Pathology and Laboratory Sciences Consultant's Division, Directorate of Professional Services, Office of The Surgeon General, April 1965.

Supplies

As the number of tests employed in Army medical laboratories grew, it was interesting to observe how many new or modified tests could trace their origin to the Army's own laboratories. However, even after a test or procedure was approved and adopted as standard, the required reagents might not have reached standardization or, if they had, they might not be readily available. This often led to requests for purchase of nonstandard items. Larger laboratories conducting research and development work were authorized to make such purchases, but many requisitions for nonstandard items originating in smaller laboratories still required final approval from the Supply Service, SGO. This service coordinated action on requisitions for special and nonstandard items with the Laboratories Division. During 1945, more than 1,000 such requisitions were referred to the division.

Following the release of ASF Circular No. 13, on 11 January 1945, which placed service command laboratories under the post commander for certain post services and activities, these laboratories were deprived of the privilege of purchasing nonstandard items locally. The privilege had been given to these laboratories because their specialized work occasionally demanded the use of small quantities of expensive reagents in chemical, toxicological, and microbiological analyses. It should be apparent that the removal of this privilege was a factor in increasing the number of requisitions for nonstandard items that required referral to the Laboratories Division, as described in the previous paragraph.

The division assisted the Supply Service in the formulation of a code letter which pertained to the 1800000 series of items in the Medical Supply Catalog and authorized the service command laboratories to monitor the preparation by hospital laboratories of some of the items in this series. The aim of the letter was to permit decentralization in the production and monitoring of laboratory reagents, thus relieving the Army Medical School of some of its many service responsibilities.²⁷

The determination of prothrombin levels came into progressively wider use as the use of Dicumarol (bishydroxycoumarin) expanded and as the prothrombin level became acknowledged as a valuable indicator of hepatocellular damage, as in hepatitis. In order to have rabbit-brain thromboplastin of consistent quality available to the hospitals, the service command laboratories were authorized to undertake its preparation and distribution to the hospitals in their commands.

The Army Epidemiological Board's Commission on Hemolytic Streptococcal Infections accepted responsibility for the production of streptococcal-typing sera, which were distributed to Army laboratories through the Army Medical School. During the period covered by the report, additional

²⁷ See footnote 17, p. 430.

service command laboratories were approved as centers for the typing of streptococci.

The Laboratories Division, in meetings with the Technical Division, SGO, and the Division of Bacteriology of the Army Medical School, reviewed the diagnostic biologicals which were intended for the laboratory truck and for use by the mobile sections of the medical field laboratory. The list was revised to conform with the newer methods available, including the shigella-typing kit.

The Laboratories Division acted on many recommendations relating to adoption of items as standard for the medical supply catalog. Among these was the specially weighed and packaged copper sulfate, to be used in the smaller laboratories which might be called upon to determine specific gravities of whole blood and plasma needed for the management of shock, burns, and other trauma. Accurate weighing of hygroscopic chemicals, such as copper sulfate, presented difficulties to installations in tropical areas. For this reason, copper sulfate, in accurately weighed amounts and sealed in glass vials, became a standard item.

As in the past, action was taken by the division to ascertain that the laboratories were apprised of newer developments, and revisions were made in the standard book list. In addition, the division recommended the issue of the *Bulletin of the U.S. Army Medical Department* to members of the Sanitary Corps, and distribution began on 1 January 1945.

Methods

In the course of their work in the medical laboratories, some laboratory officers would devise new methods or improve standard ones. Communications on these laboratory methods were forwarded to the Laboratories Division and ultimately were referred to the Army Medical School for evaluation. The Army Medical School often decided that such evaluation could be performed more promptly and efficiently if the laboratory officer who had developed the new method were permitted a short tour of temporary duty at the school. Such tours hastened the release of valuable information on methods and also resolved any difficulties which the school or other laboratories might have in duplicating results claimed by the officer who proposed the new or modified test. The Laboratories Division concurred, and it was agreed that applications for temporary duty for this purpose would be reviewed by the division.

The Coleman spectrophotometer had found wide use in the Army laboratories, and means of increasing its utility were being sought and added continuously. In preparation for continued military operations in the Pacific, instructions were distributed on the use of the spectrophotometer for conducting the thymol turbidity test, estimation of DDT (dichlorodiphenyltrichloroethane) in biological fluids, determination of Atabrine

(quinacrine hydrochloride) in the blood, bromsulphalein levels, and so forth.

In the Antilles Department Medical Laboratory, the efficiency of the acid-ether technique for detecting *Schistosoma mansoni* eggs in fecal specimens had been demonstrated. (See reference 89 in the addendum to this chapter.) The value of this method of stool examination for schistosome eggs was confirmed by the Naval Medical Research Institute. The information about the use of the test was therefore forwarded to the 18th and the 19th Medical Laboratories in the Pacific, and the method was added to Technical Manual 8-227, "Medical Laboratory Methods."

During 1944-45, overseas rates for both cutaneous and nasopharyngeal diphtheria continued to rise. The Laboratories Division alerted the service command laboratories to the potential gravity of this problem in patients returning from overseas hospitals and urged them to ascertain that hospital laboratories of their command were acquainted with laboratory methods for the diagnosis of diphtheria.

Maj. Jack Evans, Chief, Medical Laboratories Branch, had been active in directing the development of an anaerobic jar that might be used under field conditions. The Baltimore Biological Laboratories, through the Technical Division, was given the assignment of constructing a working model. This anaerobic jar was designed for employment of a variety of methods of bacterial cultivation and for use in the field where electrical current might not be available.²⁸

Training

Training continued to be a major concern during 1944-45, because laboratory personnel required specialized indoctrination for duty in the Pacific, and toward the end of this period provisions were being made for professional refresher training for those laboratory officers who had had long tours of duty in administrative positions.

The division's report for this period noted that the Army Medical School was continuing its course in tropical medicine, the need for this course being all the greater because of deployment of troops to the Pacific theaters. Special mention was made also of the contribution of the service command laboratories in the Fourth and Fifth Service Commands through their laboratory training programs in parasitology and mycology. Newly commissioned Medical Corps and Sanitary Corps laboratory officers were assigned to these and other laboratories for briefing on problems likely to be encountered in the Pacific.

The Laboratories Division added its support to a request from the

²⁸ The anaerobic culture apparatus jar (Item #4007800: List of Items for Laboratory Equipment and Supplies (class IV), Army Service Forces Supply Catalog, 1 March 1944) was standardized in 1946 and has continued in use to the present time [1965].

Army Medical Museum to have laboratory officers assigned to the museum for special and refresher study. Officers returning from overseas were to have short tours of duty there before going to other assignments, and those preparing to go overseas were able to familiarize themselves with the museum through such duty. The museum recommended also that recently commissioned medical laboratory officers, following their basic course at Carlisle Barracks, be assigned for further training to the histopathologic centers, particularly if they were to be assigned to smaller or independent laboratory installations where a trained histopathologist might be needed.

The division assisted in developing plans to carry out the provisions of ASF Circular No. 174, dated 17 May 1945, which offered official refresher courses for those laboratory officers whose assignments had been primarily nonprofessional. Training periods of 12 weeks' duration for those whose assignments had been limited to command or administrative positions were to be furnished at the Army Institute of Pathology, the Army Medical Center, the service command laboratories, and some of the ASF general hospitals.

As a means of indoctrination for, and experience in, the handling of large numbers of laboratory specimens, the division undertook the assignment of nine recently commissioned Sanitary Corps laboratory officers to Birmingham, Ala., where they were to assist in a citywide serologic testing survey. Such an experience was viewed as appropriate on-the-job training for those Sanitary Corps officers who might later be assigned to laboratories serving the separation centers.

The Laboratories Division was requested to survey the Army's post-war requirements for Regular Army officers trained in the laboratory medical specialties. The paucity of Regular Army officers trained in the medical laboratory fields made it mandatory that the number of Regular Army laboratory officers be increased. One approach to this problem was to encourage the younger career officers to enter pathology training programs.

With further reference to training, the division reviewed films and filmstrips made on medical laboratory operations in the field for use in training programs for laboratory officers and enlisted personnel. Extensive combat and other footage, collected by the MAMA's (Museum and Medical Arts Service) of the Army Medical Museum, by the Signal Corps, and by other units, was analyzed at the Signal Corps Photographic Laboratory in New York by Major Dammin for possible use in a comprehensive film on medical laboratory operations. Plans were approved for the preparation of a film bulletin with Major Dammin as the technical adviser. The film bulletin was released in 1947 as FB 8-217, "Army Medical Laboratories," and found useful both as a training and documentary film.

Other Activities

Among other Laboratories Division activities during 1945 was the review of approximately 175 manuscripts pertaining to laboratory subjects which had been referred by the Technical Information Division. These were reviewed by the staff and returned to the Technical Information Division with recommendations on acceptability for publication.

The division staff also reviewed approximately 2,000 reports of the following types: Monthly and annual reports of the service command, department, and other medical laboratories; reports of medical consultants; reports on laboratory methods and equipment; and reports on essential technical medical data.

There was abundant correspondence with Zone of Interior and overseas installations about the use of laboratory methods not described in publications available to the laboratory officer making the inquiry. In formulating replies, the Laboratories Division had generous help from the Army Medical School, the Army Medical Museum, and other divisions in the Surgeon General's Office.

The staff of the Laboratories Division joined with Capt. Charles V. Seastone, MC, of the Army Medical School in an evaluation of a *Shigella* vaccine. Many attempts had been made to prepare a polyvalent dysentery vaccine because *Shigella* dysentery had continued to be a major problem in tropical areas. The new vaccine employing the whole *Shigella* organism was tested in volunteers who were made available through the National Service Board of Religious Objectors, and was carried out at Camp Bowie, Md. Unfortunately, although there was no immediate untoward response to this vaccine, indurated and tender plaques appeared at the site of the injection after a period of 3 to 5 days. It was decided that there would be no further evaluation of vaccine of this type against dysentery.

The Army Air Forces had become increasingly concerned about the problem of diarrheal disease, and in a meeting with Col. Russel VanA. Lee, MC, Chief, Preventive Medicine Division, Air Surgeon's Office, Dr. A. V. Hardy of the U.S.P.H.S. (U.S. Public Health Service), and the director of the Laboratories Division, a broad plan of control was discussed. This plan was to include training of laboratory officers and enlisted men at the Army Medical School and at U.S.P.H.S. installations. Four survey laboratories were to be established to study groups of inductees, returnees, and convalescent patient returnees for the presence of bacterial and parasitic enteric pathogens.

In December 1944, at the request of The Surgeon General, Col. (later Brig. Gen.) George R. Callender, MC, of the Army Medical School inspected the Army Medical Museum and its Medical Illustration Service. The Laboratories Division was represented at conferences which followed General Callender's visit, and at these conferences, the division defended larger staff allotments for the Army Medical Museum as requested by the

museum, supported the program of the museum and its Medical Illustration Service, and concurred in plans for expansion and renovation of the facility.

The division was consulted on the advisability of shipping the 29th Medical Laboratory to the India-Burma Theater. The laboratory was completing its training at Fort Lewis, Wash., and had been scheduled for this assignment. However, events in the India-Burma Theater had moved rapidly in 1944 toward a reduction in operations, particularly since the fall of Myitkyina. Major Dammin had returned from a tour of duty in the theater in December 1944, and on the basis of his familiarity with the laboratory needs and plans for the theater, he recommended that the 29th Medical Laboratory not be sent since there was little prospect that the unit would function as such. He recommended that the 9th Medical Laboratory continue to serve the theater and that laboratory personnel be sent to the theater as individual or group replacements for those who had accumulated sufficient credits to permit their return to the continental United States. The 9th Medical Laboratory, under Lt. Col. Howard A. Van Auken, MC, had performed commendably in this vast theater of operations from its base in Chabua, Assam, and this fine service could have continued while the staff was being replaced. Unfortunately, for the 29th Medical Laboratory, it was shipped to the theater, and was divided into two study teams upon arrival in Calcutta. Personnel of the 29th Medical Laboratory not assigned to these teams were detailed for service at station hospitals. Thus, the 29th Medical Laboratory never functioned as a unit after reaching the theater it was expected to serve.

The staff of the Laboratories Division attended scientific meetings and visited academic institutions and Army installations, primarily to recruit laboratory personnel and to describe and discuss the aims of the Laboratories Division. The division participated in the preparation and publication of a variety of medical technical bulletins relating to the use of para-amino-benzoic acid in bacteriological culture media, the collection of blood specimens, the function and scope of Medical Department laboratories, cutaneous diphtheria, amebiasis, and schistosomiasis. At the same time, the division staff assisted in the preparation of War Department circulars on neurotropic viral diseases, the collection of specimens and their transmittal to reference laboratories, and the preparation and modification of Army regulations which pertained to the medical laboratories. Articles on laboratory methodology were prepared in the division and published in the Army Medical Department bulletin.

Additionally, when time permitted, the staff presented papers and conducted seminars on the work of the Army's medical laboratory organization. This included meetings of the Association of Military Surgeons and visits to the Civil Affairs Training School at Yale University, and the School of Hygiene and Public Health at Johns Hopkins University.

The summary of the annual report of the Laboratories Division for 1945 again noted the importance of the service command laboratories and the mission they had in serving clinical medicine, preventive medicine, and public health. Concern was restated about the histopathologic centers and the vital role which the chief of each center was expected to fulfill. It was noted also that the chief of the histopathologic center was expected to extend the services of his laboratory to hospitals of the Army Air Forces and the Transportation Corps.²⁹

The concern of the Laboratories Division about many of the problems just discussed continued into the postwar period. Minor deficiencies relating to the procurement, packaging, and distribution of laboratory items, training of laboratory personnel, and the like, had been corrected. However, there remained such questions as (1) the position of a "Laboratories Division" in the organizational structure of the Surgeon General's Office, (2) the function and role of the medical general and the medical field laboratories, (3) the need for, and the position of, a "laboratory consultant" in a command, and (4) the inadequacy of certain items of laboratory equipment; namely, incubators, water bottles, and photometers, among several others. For a discussion of these matters, the Laboratories Branch of the Preventive Medicine Division and the Army Medical Research and Development Board held a conference in Washington, D.C., on 28-29 January 1947. Conferees included many of the laboratory officers who had commanded medical general and medical field laboratories, and others who had served in hospital laboratories and other laboratory assignments. The Supply Service and other activities in the Surgeon General's Office, as well as the Army Air Forces, Army Ground Forces, and Navy were represented. The chairman of this "Field Medical Laboratory Equipment Conference" was Dr. Ralph S. Muckenfuss. Colonel Stone, chairman of the Army Research and Development Board; Col. Rufus L. Holt, MC, Army Medical School; Col. Raymond O. Dart, MC, Army Institute of Pathology, and Lt. Col. Robert LaT. Cavanaugh, MC, Laboratories Branch, SGO, represented the Army's major laboratory activities.

Not all of the decisions emanating from this conference can be recorded here, but it was agreed that (1) each major command should have a laboratory consultant who would serve in that capacity on a full-time basis, (2) the medical general laboratory should be retained but that its T/O&E (table of organization and equipment) should be modified, (3) the medical field laboratory should be continued but modified by additions required by geographic location, and (4) the Joint Research and Development Board and the Engineering Development Board in New York should undertake the development of new types of laboratory equipment and revise functional assembly specifications as required.

The progress of the development of the field medical laboratory up to the present time of writing is traced later in this chapter (pp. 527-528).

²⁹ See footnote 17, p. 430.

Medical Laboratory Development and Operations in the Army Air Forces

In September 1917, Lt. Col. (later Col.) Theodore C. Lyster, MC, was appointed the first Chief Surgeon, Aviation Section, Signal Corps, U.S. Army. One of his first acts was to recommend a research board for the study of all conditions which might affect the physical efficiency of pilots, to determine requirements for oxygen, and to develop means of providing a supply of oxygen. This proposal was accepted and Hazelhurst Field, Mineola, N.Y., was chosen as the site for the laboratory. Names which were to become outstanding in medicine were identified with the new Air Service Medical Research Laboratory. In psychology, there was Maj. Knight Dunlap; in ophthalmology, Maj. W. H. Wilmer; and physiology, Maj. Edward C. Schneider. Capt. Conrad Berens, Jr., succeeded Major Wilmer in ophthalmology research when the latter became Officer-in-Charge of the laboratory. A medical research board to advise the laboratory was under the chairmanship of Dr. Yandell Henderson, the civilian member of the board. The Air Service Medical Research Laboratory represented the first step taken to place aviation medicine on a sound scientific basis in America.³⁰

Important events which led to the establishment of the Army Air Forces in 1941 were the following developments in the Air Corps of the War Department. On 1 April 1939, the Medical Section of the Air Corps, under Lt. Col. (later Brig. Gen.) Malcolm C. Grow, MC, was redesignated the Medical Division, and assigned to the Training Group, Office of the Chief of the Air Corps. In September of the same year, the Medical Division was transferred from the jurisdiction of the Training Group and was made a major subdivision of the Office of the Chief of the Air Corps. Following this, on 30 October 1941, Col. (later Maj. Gen.) David N. W. Grant, MC, was designated Air Surgeon, in addition to duties as chief of the Medical Division. The final step in reorganization was the transfer of the Medical Division to the Air Surgeon's Office on 16 February 1942.

Following the establishment of the Army Air Forces by the War Department on 20 June 1941, a provision was made to place medical personnel at Air Corps stations under the jurisdiction of the Army Air Forces. Thus, jurisdictional authority over medical personnel was to concern directly neither the Commanding General of the Army Air Forces nor The Surgeon General of the Army but only components within the Army Air Forces. Centralization of medical services for the Army Air Forces was almost complete with the order which transferred officer personnel from the Medical Division, Office of the Chief of the Air Corps, to the Air Surgeon's Office. By May 1942, the Office of the Air Surgeon, which reported to Head-

³⁰ Link, Mae Mills, and Coleman, Hubert A.: *Medical Support of the Army Air Forces in World War II*. Washington: U.S. Government Printing Office, 1955, pp. 11-13.

quarters, Army Air Forces, had the School of Aviation Medicine and the Aero-Medical Research Laboratory under its jurisdiction, and also received reports from the surgeons of the various commands.

Medical laboratory activities appeared first with the establishment of the AAF (Army Air Forces) regional hospitals and convalescent centers. Some of these installations had their origins in station hospitals serving airbases. Ultimately, the major hospitalization for the Army Air Forces was carried out in its 30 AAF regional hospitals. However, they were served by the service command laboratories, the Army Medical Museum, and the Army Medical School.

Training at the AAF School of Aviation Medicine was concentrated on tropical medicine, with courses beginning in April 1942. As the importance of such training increased, a Department of Tropical Medicine was formed. Other courses of instruction which had been in progress at the school were expanded. These courses were concerned with wound injury, including burns and fractures, and the study of aircraft injury as investigated by the school's Pathology Department. Such instruction was incorporated also into the Aviation Medical Examiners' Course at Randolph Field, Tex.

In January 1945, a bacteriology laboratory was established at the School of Aviation Medicine, the staff and facilities having been transferred from the AAF regional hospital at Scott Field, Ill. Principal interests of this laboratory were diarrheal disease and streptococcal infection. Following the transfer of these laboratory activities to the School of Aviation Medicine, the AAF Central Diarrheal Disease Control Program was established at the school. As noted previously, the Laboratories Division of the Preventive Medicine Service assisted in the formulation of this program.

Many studies of aircraft injuries were carried out at the school, mainly under the direction of Dr. George M. Hass, who was in charge of the Pathology Department. Medical aspects of a variety of aircraft accidents were investigated. The types of internal injuries sustained in aircraft accidents received particular attention from Dr. Hass and his staff at the School of Aviation Medicine. Relationships between the time of day, types of aircraft, and types of injury to flying personnel were the subject of concentrated study. From these correlative investigations came recommendations for better aircraft design. Studies on the types of trauma sustained in aircraft also involved the use of experimental animals at the school. Apparently, from the accounts of medical laboratory work conducted by the Army Air Forces, a concerted effort was made to study the major problems of flight personnel and the interrelationships between man and the airplane as a weapons system.

ARMY MEDICAL MUSEUM

Early History

History has recognized the establishment of the Army Medical Museum as the most notable achievement of Surgeon General William A. Hammond.⁸¹ On 21 May 1862, he announced:

* * * * *

As it is proposed to establish in Washington, an *Army Medical Museum*, Medical officers are directed diligently to collect, and to forward to the office of the Surgeon General, all specimens of morbid anatomy, surgical or medical, which may be regarded as valuable; together with projectiles and foreign bodies removed, and such other matters as may prove of interest in the study of military medicine or surgery.

These objects should be accompanied by short explanatory notes.

Each specimen in the collection will have appended the name of the medical officer by whom it was prepared.

This proposal appeared at the end of the one-page Circular No. 2, Surgeon General's Office, Washington City. In this same circular, General Hammond instructed medical officers to mention in their "monthly Reports of Sick and Wounded" details about the management of surgical cases; remarks about the characteristics of fevers, diarrhea and dysentery, and "other preventible diseases"; and accounts of "pathological results" when post mortem examinations had been performed.

Although it was designated a "medical museum," General Hammond foresaw the development of a great graduate school of military medicine in Washington, where officers might become or remain apprised of new advances in medicine and in biological science. The first Curator of the museum, Dr. John H. Brinton, undertook his new responsibilities with much enthusiasm. Within a year, he established a photographic department under Dr. Joseph J. Woodward, a pioneer in medical photography and photomicrography. It might be noted here that, well in advance of the circular letter announcing the establishment of the museum, General Hammond had ordered to his office Brigade Surgeon Brinton, who was on duty with the Army of the Mississippi, and Assistant Surgeon Woodward, who was serving with the Army of the Potomac, ostensibly to prepare the medical and surgical sections, respectively, of the history of the Civil War. What their duties were to be in Washington were known best to them. After their arrival in Washington, their official duties were announced in Hammond's Circular No. 5, dated 9 June 1862, which also urged medical officers to supply coeditors Brinton and Woodward with medical and surgical reports, essays, and results of investigative work, "for which full credit will be given in the forthcoming volumes."

Brinton and Woodward applied themselves effectively to two major efforts, the development of the museum and the writing of the "Medical and Surgical History of the War of the Rebellion." They saw the successful

⁸¹ See footnote 12, p. 425.

launching of the museum as well as the publication of the sixth and last volume of this monumental history which appeared in 1888.

The new museum's collection grew so rapidly that in the first 15 years of its life, there were four moves to progressively larger quarters, the last taking the museum activity to the corner of 7th Street and Independence Avenue, SW, in Washington (fig. 44). It was in this building, the "old red brick," that the problems of World War II were faced by Col. James Ash (Curator, February 1937 to December 1946) and his staff.

The succeeding decades were filled with exciting events for the museum, many emanating from the efforts of such outstanding Army scientists as Sternberg, who established the Army Medical School in the museum in 1893; John S. Billings (Curator, 1883-93), who was the main-spring in the growth and stature of the Army Medical Library; Walter Reed (Curator, 1893-1902), who became world renowned for his work with the Typhoid Board and the Yellow Fever Board, and for the Army Medical School; and Frederick F. Russell (Curator, 1907-13), who developed typhoid vaccine and introduced its Army-wide use.

World War I

The superb accomplishments of the museum during World War I were mentioned briefly at the beginning of this chapter. The growth of the museum, as measured by accessions, and its stature as a teaching institution increased progressively, as described by Surgeon General William C. Gorgas



FIGURE 44.—Fifth home of the Army Medical Museum, as it appeared in 1945.

in 1917.³² For the Curator, Col. William O. Owen, there were many trials ahead, because in the rush to fund many new medical activities incident to entering World War I, the museum budget had not been increased. However, more than a larger budget was needed to prepare the museum for the tasks it faced. A shortage of pathologists and the demands on the laboratories, resulting from epidemics in the Zone of Interior, especially at recruit training centers, and in the American Expeditionary Forces, taxed the laboratories to their limit. Little time remained which might be assigned to the collecting and processing of specimens.³³

Although Army medical officers who were eminent scientists occupied the position of Curator between the World Wars, among them Col. Charles F. Craig, MC, and Colonel Callender, the period was not one during which sufficient attention and funds could be mobilized in order to profit from and build upon the experience accumulated in World War I and to prepare for World War II.

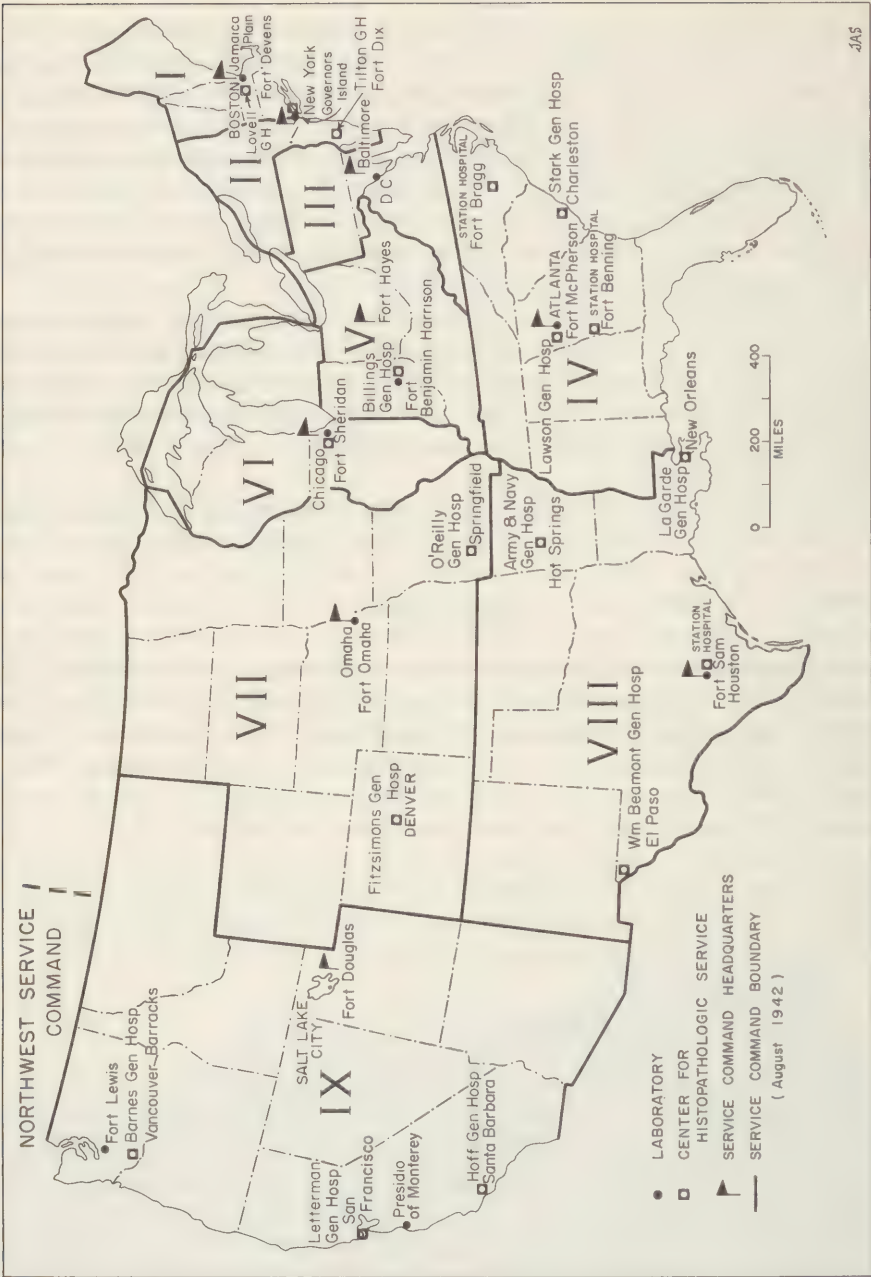
At the beginning of World War II, the museum had four major divisions: the Medical Illustration Service; the American Registry of Pathology; the museum itself, as a separate and distinct activity; and the Department of Pathology. The Department of Pathology was responsible for an active diagnostic service that was ready to assist the medical officer stationed anywhere in the Army's far-flung installations. The responsibility for consultative service, and also instruction in pathologic anatomy, prevented the initiation and pursuit of investigative work despite a highly competent staff. In addition to Colonel Ash (Curator, February 1937 to December 1946), the following were to become identified with the newer knowledge of the military problems presented by World War II: Lt. Col. Balduin Lucké, MC; Maj. (later Lt. Col.) R. Philip Custer, MC; Maj. Hugh G. Grady, MC; Maj. Nathan B. Friedman, MC; Maj. Webb Haymaker, MC; Capt. Edward B. Smith, MC; Maj. Arthur C. Allen, MC; Maj. Ruell A. Sloan, MC; and Dr. Sophie Spitz, among others.

Histopathologic Centers

As mentioned previously (p. 434), the system of histopathologic centers was announced in The Surgeon General's Circular Letter No. 121, dated 11 December 1941. Nineteen histopathologic centers were identified initially, with the Army Medical Museum ultimately discontinuing its function as such a facility (map 10). The histopathologic centers worked as extensions of the Army Medical Museum, which was the ultimate repository of information and material on each case studied. This system provided a central reference file on each case for correlative study and later followup by a Veterans' Administration unit in the museum.

³² Annual Report of The Surgeon General, U.S. Army. Washington: Government Printing Office, 1917, pp. 325-327.

³³ Ewing, James: Experiences in the Collection of Museum Material From Army Camp Hospitals. International Association of Medical Museums Bulletin VIII, December 1922, p. 27.



MAP 10.—Service command laboratories and histopathologic centers in the Zone of Interior.

World War II

Before World War II, the staff of the museum consisted of three pathologists; the number rose to 20 during the war. Supporting this professional staff were about 100 others, including approximately 30 enlisted men and women and 70 civilian technicians, secretaries, and other workers. There were 17 distinguished consultants on the roster of the museum. Each resided at the museum for periods of several weeks to several months and worked as advisers on every phase of the museum's operation. Sharing responsibilities with the Curator, Colonel Ash, was Colonel Lucké as Deputy Curator, who left a distinguished post in pathology at the University of Pennsylvania to assist in the wartime development of the Army Medical Museum. He was active in the museum's Department of Pathology and was responsible for characterizing the hepatic lesion which followed the injection of the yellow fever vaccine employed early in the war. Material from early fatal cases showed a lesion different from that observed in yellow fever, and sets of slides were sent to Army hospital and other laboratories in order that pathologists could familiarize themselves with this hepatic lesion.³⁴ Investigators working under the Army Epidemiological Board later established the lesion as a viral hepatitis.³⁵

There was a universal eagerness by pathologists to learn more about tropical diseases. Their desire was met by publications and study sets from the Army Medical Museum. A definitive study, with contributions from many workers at the museum, was prepared as a publication released under the authorship of Colonel Ash and Dr. Spitz.³⁶ Interest in tropical diseases was also manifested by many of the country's leading medical schools. In response to this, the museum prepared and distributed to the medical schools during December 1943, more than 2,300 lantern slides, 1,000 tissue blocks, and 300 stained sections of tissue, along with pertinent clinical records and autopsy protocols. This operation was to satisfy not only a curiosity but also a training need, because medical students and physicians, as future medical officers, required this new knowledge in preparation for possible assignments in tropical areas. To meet these growing demands, there had to be constant accession of teaching material by the museum. This material was solicited through letters from the Surgeon General's Office to the membership of the national societies of pathology and tropical medicine.

During 1945, the museum received records and tissues from nearly 19,000 autopsies, along with more than 20,000 surgical specimens. From

³⁴ (1) Lucké, B.: The Pathology of Fatal Epidemic Hepatitis. *Am. J. Path.* 20: 471-593, May 1944. (2) Lucké, B.: The Structure of the Liver After Recovery From Epidemic Hepatitis. *Am. J. Path.* 20: 595-619, May 1944.

³⁵ Paul, John R., and Gardner, Horace T.: Viral Hepatitis. In *Medical Department, United States Army. Preventive Medicine in World War II. Volume V. Communicable Diseases Transmitted Through Contact or By Unknown Means.* Washington: U.S. Government Printing Office, 1960, ch. XVII.

³⁶ Ash, James E., and Spitz, Sophie: *Pathology of Tropical Diseases: An Atlas.* Philadelphia: W. B. Saunders Company, 1945.

this vast volume of material referred to the museum for diagnosis, consultation, and cataloging, cases were selected for teaching in the medical schools and for training at the museum, histopathologic centers, and other Army laboratories (fig. 45).

Training programs conducted by the museum for officers who were to direct histopathologic centers and also for those preparing for specific overseas assignments have been cited previously in this chapter. The pressure of duties in their own laboratories tended to reduce the number of hospital pathologists and other pathologists who could be brought to the museum for even short periods of refresher or advanced training. About 150 officers, however, who were given this training opportunity at the museum, learned more about its functions and its service to the Army.

American Registry of Pathology.—The American Registry of Pathology had its beginning in the early 1920's. In 1921, the American Academy of Ophthalmology and Otolaryngology, under the auspices of the National Research Council, sponsored the establishment of the first registry. In 1925, there appeared the Registry on Lymphatic Tumors, under sponsorship of the American Association of Pathologists and Bacteriologists. The registries



FIGURE 45.—Typical conference, utilizing the multiviewer, held at the Army Medical Museum to review slides submitted for consultation and for teaching sessions.

grew in number, so that there were eight at the beginning of World War II. Five new registries were added during the war. The case accessions for the registries totaled 48,000 for the war period.

The files of the registries contain case records of special disease categories with emphasis on tumors. These records are of superb teaching value because they depict, through actual case reports, the manner in which a lesion can be identified and the course which it may take when modified by therapeutic procedures. They are invaluable as reference cases, because if contemplated methods of therapy are to be acceptable, they must be more effective than those used in the past. Thus, guides to future therapy of tumors and other lesions are contained in the registries. Additionally, the files contain teaching materials of inestimable value to medical schools and postgraduate programs, not only for pathology but also for radiology and the clinical disciplines.

Army Institute of Pathology.—As might be expected, the original Department of Pathology, under the Army Medical Museum, grew enormously during the early years of the war and, in 1944, Colonel Ash chose to refer to this department as the Army Institute of Pathology (fig. 46). This title identified the department as a division of the Army Medical Museum. In



FIGURE 46.—Histology Laboratory of the Army Institute of Pathology. The laboratory processed great numbers of specimens required for the Institute's diagnostic and teaching services.

1946, however, the museum was designated the Army Institute of Pathology. Simultaneously, the ranking officer of the Institute was given the title of Director, and the term "Curator" remained with the Army Medical Museum which became a division of the Institute.

The subsequent history of the museum, and its growth as the Army Institute of Pathology and later as the Armed Forces Institute of Pathology, was characterized by a continuance of three major activities which constituted the original mission; namely, consultation, education, and research. Although each of these activities continued to expand during the war, the largest, by far, was consultation, followed by education and research. The early postwar years brought a change in emphasis and the resurgence of research as the major activity of what is now the Armed Forces Institute of Pathology. To give due credit to those who labored to educate not only the military but also the civilian medical profession through publication of important observations made during the war years, references to their work have been collected in the addendum to this chapter (pp. 599-603).

ARMY MEDICAL SCHOOL

Its Early Years

The Army Medical School was established under General Orders No. 51, dated 24 June 1893, on the recommendation of Surgeon General Sternberg. His remarkable career and his contributions to laboratory science in general and to Army laboratory medicine in particular have already been cited. His pre eminence in medicine and in leadership was a strong force in guiding the new school. He appointed to the faculty Maj. John S. Billings as professor of military hygiene and Capt. Walter Reed as professor of clinical and sanitary microscopy and director of the pathological laboratory. Major Billings had just completed a 10-year tour of duty as Curator of the Army Medical Museum, and Captain Reed, a 3-year period of training at the Johns Hopkins Hospital. Lectures at the school were given by such outstanding authorities as Dr. Charles W. Stiles in parasitology and Dr. W. W. Keen in surgery.

The quarters which housed the Army Medical School consisted of two rooms in the Army Medical Museum. This modest beginning was almost a condition for the founding of the school; General Sternberg had promised that it would be an important Medical Corps activity which would not require a separate or additional appropriation, since quarters as well as personnel were to be shared by the school and the museum. Outstanding members of the school faculty who served also on the museum staff were Major Billings and Capt. Walter Reed. Indeed, Captain Reed became

Curator of the museum in the same year that the school was founded.³⁷ He was promoted soon afterward to the grade of major.

An early and outstanding achievement of the school resulted from the work of Major Reed and his Commission on Yellow Fever. This commission, appointed by Sternberg in May 1900, included Major Reed, Dr. James Carroll, Dr. Jesse W. Lazear, and Dr. Aristides Agramonte. Major Reed had entered the military service in 1875 and after tours of duty which took him to many western posts, he was ordered, in 1890, to the Johns Hopkins Hospital where he came into contact with the most advanced work in the new field of bacteriology. There, under the stimulating guidance of Dr. William H. Welch, he prepared himself for the important assignment he was to be given at the Army Medical School 3 years later.

The work in Cuba on yellow fever began with a discounting of the importance of Sanarelli's *Bacillus icteroides*. Ultimate success in identifying yellow fever as an infection transmitted by the mosquito, *Stegomyia fasciata*, later termed "*Aedes aegypti*," had its basis in observations which had just been made on the transmission of malaria by mosquitoes of the genus *Anopheles*. It was related also to the studies of Surgeon Henry R. Carter, U.S. Marine-Hospital Service, who had attempted to establish an insect vector in yellow fever dissemination; to the observation that the sanitation work in Havana did not reduce the yellow fever rate, thus eliminating filth as a factor in transmission; and to the observation of Dr. Carlos Finlay of Havana, who had concluded that the infection was mosquito-borne and was probably carried by a member of the genus *Stegomyia*. The work of the Yellow Fever Commission was completed in 1901, and its report received worldwide attention.³⁸ Others in the Army who had assisted and in turn were aided by these observations were Maj. Gen. Leonard Wood, who was Military Governor of Cuba, and Major Gorgas, who was then his chief sanitary officer in Havana. Effective control of mosquitoes led to a report by The Surgeon General, in 1903, that no case of yellow fever had originated in Cuba for the preceding 2 years.

One of the early graduates of the Army Medical School was Lt. Bailey K. Ashford, MC, who received his training in parasitology under Dr. Stiles. In 1899, Lieutenant Ashford began a study of Puerto Rican anemia, which he found to be due to hookworm infection. As a result of his findings, a control and treatment program was initiated which brought astounding results.

Among other important events in the early history of the school was the development of typhoid vaccine, which was directed by Maj. (later Brig. Gen.) Frederick F. Russell, MC.

³⁷ See footnote 12, p. 425.

³⁸ Reed, W., Carroll, J., and Agramonte, A.: The Etiology of Yellow Fever. In Report of the Surgeon-General of the Army to the Secretary of War, for the fiscal year ending June 30, 1901. Washington: Government Printing Office, 1901, pp. 187-202.

Expansion During World War I

Major expansion of all activities of the Army Medical School occurred just before the United States entered World War I.³⁹ Classes for instruction of officers and enlisted men were enlarged and increased in number. The production of biologic products for diagnostic, prophylactic, and therapeutic use by the Army, the Navy, and Government bureaus was expanded. Research, particularly on infectious diseases, was broadened, and new work was initiated on anticipated problems, such as war wounds. Physical examinations of officers and enlisted men were performed at the school, and new physical standards were developed. A broad program of review of laboratory methods, supplies, and equipment was carried forward at the school. This effort was reflected in the outstanding laboratory service that was rendered by the hospitals and laboratories during World War I. Much of what was introduced and developed by the school at that time was readily adopted by the Medical Department during the limited national emergency preceding, and the early years of, World War II.

Between World War I and World War II

Despite limited budgets for research, the Army Medical School established a creditable record of achievement between World War I and World War II. Indeed, the 1942 report of the Committee to Study the Medical Department praised the school for its research accomplishments and for its aims and efforts during the period of mobilization.⁴⁰ The committee recommended expansion of the Army's medical research program with the major locus in a separate facility to be developed at the Army Medical School (fig. 47). Although there was progressive wartime expansion of medical research within the Army, no authorization was given for a separate facility which might devote its efforts primarily to medical research.

Training of laboratory technicians.—Before the expansion for World War II, the Medical Department had trained approximately 500 technicians per year, of which 30 received training as medical laboratory technicians in a 4-month course. Annual needs were met by this number of graduates, since 3-year enlistments were high, as were the reenlistments. However, the competence of the medical technology course graduates did not raise the performance of the laboratories to a sufficiently high level, and the laboratories were therefore considered to be understaffed before World War II. To improve the caliber and to increase the capabilities of the graduates, the training period in medical technology was increased in 1939 to 1 year. The first session of increased length began on 15 September 1939, at

³⁹ The Medical Department of the United States Army in the World War. Washington: U.S. Government Printing Office, 1927, vol. VII, pp. 393-422.

⁴⁰ Miscellaneous Correspondence and Reports of the Secretary of War's Committee to Study the Medical Department of the Army, 1942-43. [Official record.]



FIGURE 47.—East entrance of the Army Medical School, as it appeared in 1945.

the Medical Department Professional Service School, Army Medical Center, but the need for graduate medical technologists was so great that this training program was terminated on 28 June 1940, and the period of training was again set at 4 months (fig. 48).

Major expansion of the training program occurred early in 1941, when Medical Department enlisted technicians schools were opened or expanded at the Army Medical Center; at the Army and Navy, William Beaumont, Letterman, and Fitzsimons General Hospitals; and at the Fort Sam Houston Station Hospital. In addition to training in medical laboratory work, technicians were also trained for work as operating room and ward assistants and as dental and X-ray technicians. The establishment of these schools made possible an enormous expansion in the number of medical technicians in training at any one time. In 1940, 112 student technicians were enrolled, but after the six new courses began, students were enrolled at the rate of 1,300 per month. Despite this expansion, it was apparent by June 1942 that additional technicians were needed. New construction was authorized for schools to be added at Billings, Lawson, and O'Reilly General Hospitals. This addition doubled the number of graduates in medical technology. For a time during fiscal year 1944, it was possible for the schools to operate at a reduced schedule. However, as plans were being made early in 1944 for an expansion of military operations, classes returned to a two-shift schedule at most of the schools. The major retrenchment in these training programs did not come until December 1944. During the



FIGURE 48.—Students in the medical laboratory technicians course at the Army Medical School. (Top) Bacteriology class. (Bottom) Chemistry class.

period from 1 July 1941 to 31 December 1944, 7,483 students were graduated from the training programs for medical laboratory technicians.

Training for enlisted technicians was given also in many of the larger laboratories, such as the general hospital, service command, department, and medical general laboratories. On the basis of performance in a proficiency survey, a service command laboratory would often recommend additional training for the technicians serving in a particular hospital or other medical laboratory. Within the larger laboratories themselves, enlisted technicians were trained in various divisions of a laboratory in order that there might be depth in the operation of each division. This was expected to assure continuity of operation should an enlisted technician be transferred or lost to the laboratory for any other reason.

Organization of the Medical Department Professional Service Schools.

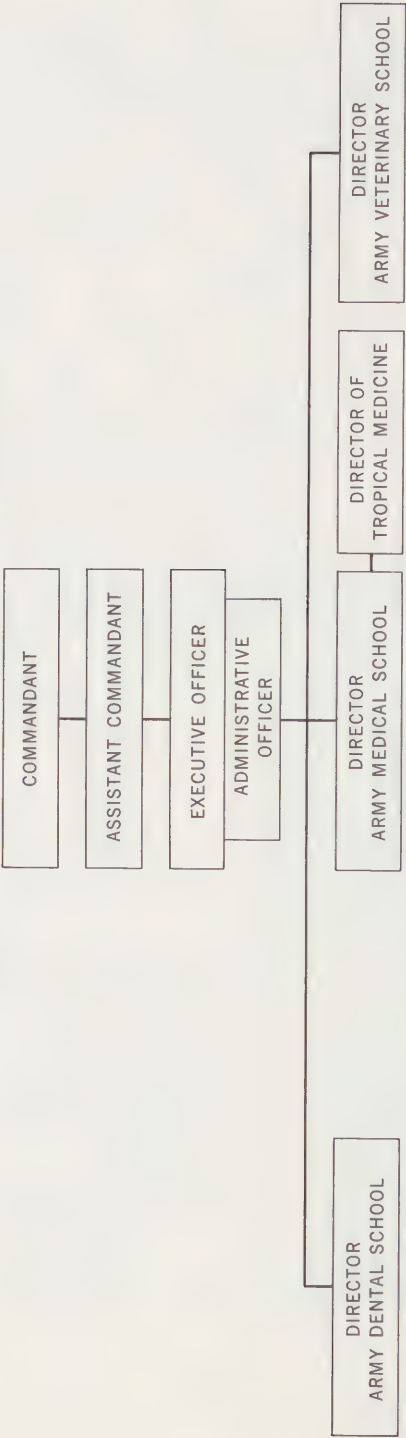
—The organization chart for fiscal year 1945 shows the Medical Department Professional Service Schools at the Army Medical Center listed as the Army Medical School, the Army Dental School, and the Army Veterinary School. Commandant of the Medical Department Professional Service Schools in 1945 was Maj. Gen. Shelley U. Marietta, and the assistant commandant was Brig. Gen. George R. Callender. General Callender was also the director of the Army Medical School. The director of the tropical medicine course was Col. Richard P. Strong, MC (chart 11).

During this active period, staff charts of the Army Medical School showed as many as nine officers in the large Division of Virus and Rickettsial Diseases, eight officers in the Division of Parasitology, and from three to six officers in the remaining divisions (chart 12).

Specimens for teaching.—One of the major activities of the Army Medical School which continued at a high level was the provision of teaching materials by the Division of Parasitology to training programs in other Army medical laboratories, to public health units, and to medical schools. During 1945, more than 62,000 specimens were delivered for use in training programs. Serving the school at that time as technicians were 66 enlisted men in the intermediate noncommissioned grades. More assistance of this type could have been utilized, but because of personnel restrictions no additional enlisted technicians could be assigned to the Army Medical School. This was lamented because enlisted men who had received exceptional experience and training overseas could not be assigned to the school at a time when their talents were much needed in the research and training programs.

The tropical medicine course.—Receiving special attention in the Army Medical School's annual report for 1945 was the decreasing size of the tropical medicine classes. There were training spaces authorized for twice the number of officers who were assigned to the six courses given that year. Classes could not be filled from the Army and Navy Medical Departments because too many officers were in assignments from which they could not

CHART 11.—*Medical Department Professional Service Schools, 1945*



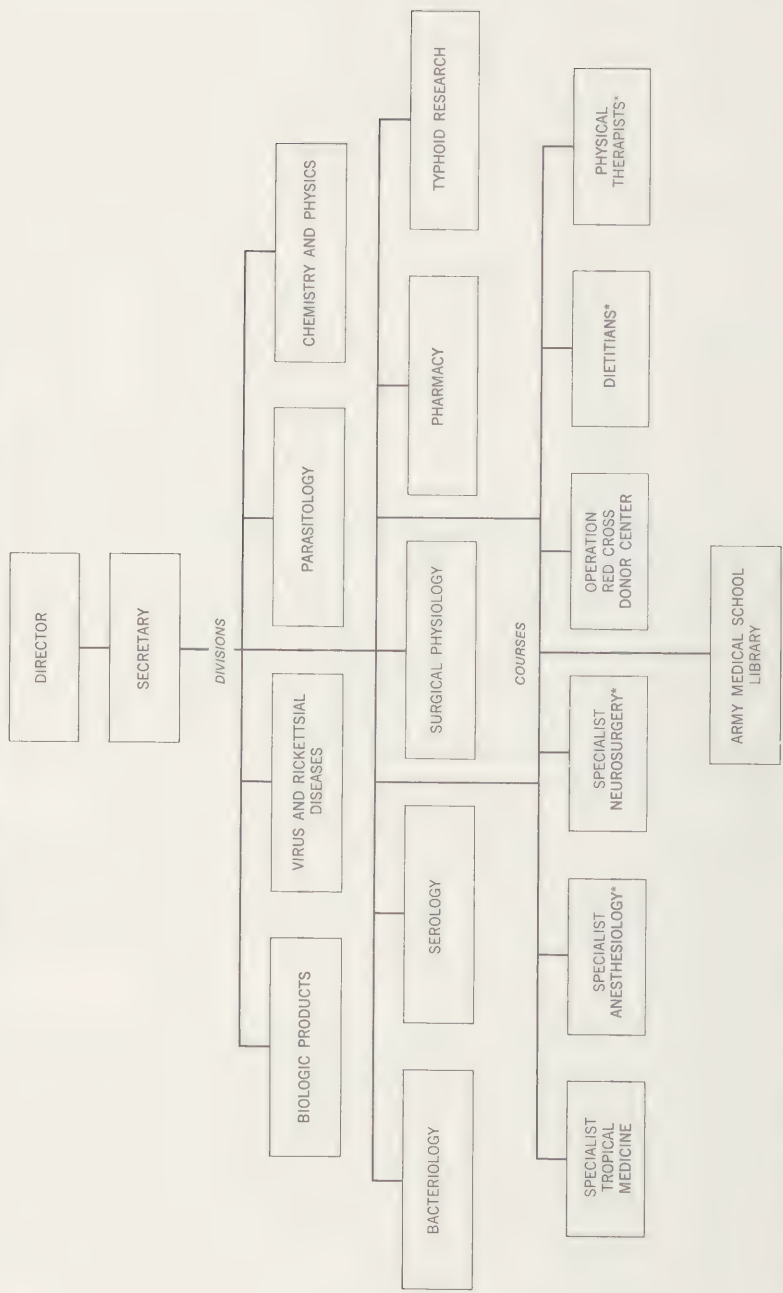
be relieved. Thus, potential students were deprived of valuable training. However, able students came from Allied military Medical Departments and other sources. At the graduation exercises for the twenty-fifth class of tropical medicine given at the school in June 1945, 11 members of the class were U.S. Army Medical Department officers, 18 were from the Royal Canadian Army Medical Corps, 15 were from the Royal Canadian Air Force, and two were medical missionaries. Staff members of the tropical medicine course included outstanding talent from the Army Medical School, the Army Veterinary School, the Army Medical Museum, and the Walter Reed General Hospital, as well as staff members of the Surgeon General's Office. During 1945, 290 officers were graduated from the tropical medicine course. Because few veterinary officers could be spared from assignments at camps, posts, and stations, those who could be assigned to the Veterinary School for training appeared in small numbers. The enlisted technicians school also had periods of low activity because many of the enlisted men occupied positions from which they could not be released.

Wide range of activities.—The production of diagnostic biologicals, both medical and veterinary, increased enormously. There was more and more demand for chemical and bacteriological examination of food products by the Army Veterinary School. Research was accelerated and included work on a polyvalent shigella vaccine, epidemic and scrub typhus, and Japanese B encephalitis. Efforts were made to improve the antigenicity of, and reduce the systemic reaction to, typhoid vaccine. The serology of malaria and amebiasis, together with attempts to eliminate false-positive serologic reactions for syphilis, were investigated in the Serology Division.

The blood program, expanded to meet the needs in the combat areas, was applauded by all medical officers serving in these areas. This development reflects great credit upon General Callender, Commandant of the Army Medical School, who initiated the Army blood program as early as 1940. As the program grew, welcome assistance came from other agencies, which included the National Research Council, the American Red Cross, the U.S. Navy, the National Institute of Health, and many of the commercial medical laboratories.

Among the many new responsibilities assigned to the Army Medical School at the beginning of World War II was its function as the Third Service Command Laboratory. The school had functioned as a reference or general laboratory for the entire Army during peacetime. Preparations for the war necessitated the transfer of many of the school's responsibilities to the new service command laboratories which were the successors to the corps area laboratories. To aid in the decentralization of reference laboratory work, which would permit the Army Medical School to focus on training and research as well as on the production of biologicals, and to develop closer laboratory support for overseas stations, four department laboratories were planned, one each in Puerto Rico, Panama, Hawaii, and the Philippines. The Hawaiian and Puerto Rican Department Laboratories

CHART 12.—*Organization of the Army Medical School*



*Courses conducted at Walter Reed General Hospital.

NOTE.—Biologic Products Laboratory, Lansing, Mich., not shown on chart; Division of Food and Nutrition transferred to Chicago, Ill., 14 Sept. 1944; Division of Roentgenology transferred to Memphis, Tenn., 1 Jan. 1943; Army Ground Forces Refresher Course authorized (conducted at Walter Reed General Hospital).

began operation early in 1942. In Panama, the Gorgas Hospital and the adjacent Board of Health laboratory served as a department laboratory, but in the Philippines, enemy action prevented the establishment of a department laboratory.

As the reduction of reference work to be done at the Army Medical School was achieved through the establishment of these and other laboratories, the school encountered new demands for expanding its training and research programs. The principal hindrances to needed expansion were shortages of trained personnel and space. The decentralization of laboratory work pertained primarily to service work, in that the Army Medical School remained the reference laboratory for unusual strains of bacteria, viruses, and rickettsiae which might be related to diseases in man or animals (fig. 49). However, the laboratories of the Army Medical and the Army Veterinary Schools were concerned not only with the identification and characterization of newer agents but also with the production of vaccines, diagnostic antisera, and antigens as mentioned previously. The major prophylactic biologicals were the typhoid and the equine encephalomyelitis vaccines (fig. 50).

The Army Veterinary School played a major role in the mission of the Veterinary Service under Col. (later Brig. Gen.) Raymond A. Kelsner, VC,



FIGURE 49.—Typhus research in the Serology Section, Virus and Rickettsial Diseases Division, Army Medical School.



FIGURE 50.—Production of vaccines at the Army Medical School. A. Culture flasks being inoculated for typhoid vaccine. B. Vaccine vials being filled and capped at the Lansing, Mich., branch of the school.



FIGURE 50.—Continued. C. Eggs being inoculated for virus propagation.

chief of the Veterinary Division in the Surgeon General's Office, since it represented the focal point for all work relating to food inspection, animal service, and laboratory services with reference to the quality of food products of animal origin. This mission is described well in a volume prepared by Lt. Col. Everett B. Miller, VC.⁴¹ The volume describes, in a lucid readable style, the contributions of Veterinary Corps laboratory officers, particularly in the medical general, the medical, the service command, and also the department laboratories.

SERVICE COMMAND AND DEPARTMENT LABORATORIES

Organization and Development

Much of the credit for the growth of service command and department laboratories as wartime successors to the corps area laboratories, and the definition of their important functions, goes to Colonel Simmons, who recognized the need for these laboratories early in 1940 as preparation progressed for the anticipated mobilization. He initiated the action to reconstitute the corps area and department laboratories as activities es-

⁴¹ Medical Department, United States Army. *Veterinary Service in World War II*. Washington: U.S. Government Printing Office, 1961.

essential to the functions of the office of the Command Surgeon. Their role was to be comparable to that of State health department laboratories, but they were to serve even larger geographic areas and also a variety of Medical Department activities, including clinical facilities. Following communications between Colonel Simmons and Maj. Gen. James C. Magee, The Surgeon General, it was recommended to The Adjutant General, in October 1940, that a central laboratory be established in each corps area so that laboratory service could be provided to all commands located within the geographic limits of the corps area.⁴² Several corps area laboratories had been in operation during peacetime, but only one had been in continuous service; namely, the II Corps Area Laboratory, in New York City. The original plan called for having these laboratories serve a corps area through the surgeon in the corps area headquarters and be located near headquarters. In order that they might function in the manner intended, they were placed, by AR (Army Regulations) No. 40-305, under the immediate jurisdiction and control of the corps area commander and his surgeon, and their personnel were to be assigned to no duties other than those prescribed by the War Department regulation establishing these laboratories. All assignments of personnel to the laboratories were to be made by the War Department. The pattern having been set, action was taken to establish such laboratories in each of the nine corps areas with two to be active in the large IX Corps Area. The minimum staff was to consist of four commissioned officers, 14 enlisted men, and 11 civilian technicians. As mentioned earlier, the Army Medical School was to act as the III Corps Area Laboratory. On 30 November 1940, The Surgeon General was authorized to effect the establishment of these laboratories. Colonel Simmons, through meetings with the Commandant, Army Medical School, expedited plans for the type of structure which would house the laboratory and, in December 1940, the Hospital Subdivision of the Surgeon General's Office prepared definitive plans for the buildings.

Of considerable interest was an early attempt to activate a corps area laboratory at a station hospital. This involved the Station Hospital, Fort Sheridan, Ill., in the VI Corps Area. The directive assigning responsibilities of a corps area laboratory to a hospital laboratory did not guarantee its functioning as one, because there was no assurance that personnel of the station hospital laboratory would be freed from other duties in order that they might also serve the corps area laboratory. This danger was noted by Colonel Callender who, in 1940, was assistant commandant of the Army Medical Center.⁴³ He observed also that the II Corps Area Laboratory had encountered difficulties because laboratory personnel were given assignments in addition to those which identified them with the corps area labora-

⁴² Letter, The Surgeon General, to The Adjutant General, 30 Oct. 1940, subject: Activation of Corps Area Laboratories.

⁴³ Letter, Col. George R. Callender, MC, to The Surgeon General, 10 Oct. 1940, subject: Corps Area Laboratories.

tory. There was uniform agreement on the intent of the 1942 AR No. 40-305, which was designed to insure not only the assignment of properly qualified officers by the War Department but also their insulation from other duties which might interfere with their primary responsibilities to the corps area laboratory. Unfortunately, ASF Circular No. 13, by removing this protection, was detrimental to the service command laboratory's operation and impaired its function by incorporating it into the post on which it was located.

Because similar laboratory activities were needed in overseas stations, The Surgeon General requested the establishment of department laboratories in Puerto Rico and in Panama, each of these areas having been designated as departments. Early in 1941, the same letter which established the new corps area laboratories also authorized the establishment of department laboratories in the Panama Canal Zone and in Puerto Rico.⁴⁴ The laboratories in Hawaii and the Philippines were not included in the 1941 activation order because they were considered adequate for their current responsibilities. While a department laboratory was authorized in 1942 for Hawaii, enemy action forestalled any move to activate a department laboratory in the Philippines.

As soon as The Adjutant General's action of 15 January 1941 to establish these laboratories was announced, guides were issued in a letter from The Surgeon General on the staffing and operation of the new laboratories.⁴⁵ Laboratories were to be commanded by a Regular Army medical officer in the grade of lieutenant colonel who was competent in public health laboratory procedures and in epidemiology. A second officer was to be a medical bacteriologist and serologist, and also familiar with public health laboratory work. The third officer might be a Sanitary Corps laboratory officer, trained and experienced in public health chemistry and toxicology. The fourth officer was to be a Veterinary Corps officer experienced in veterinary bacteriology and serology, and also in the examination of food of animal origin. A trained medical entomologist was to be assigned to laboratories in areas where insect-borne diseases were of importance, since such laboratory support would be essential in the IV, VII, and VIII Corps Areas, and also in the Puerto Rican and Panama Canal Departments. Also authorized were 14 enlisted men, most of them trained as laboratory technicians, and two clerk-stenographers. Additional guidance for corps area and department surgeons and the commanding officers of laboratories was contained in a six-page letter which outlined in detail the functions, personnel, equipment and supplies, transportation, reports, and also the locations of the corps area and department laboratories.⁴⁶ This directive continued as the major guide for these laboratories until 1942, when the corps areas

⁴⁴ Letter, The Surgeon General, 15 Jan. 1941, subject: Corps Area and Department Laboratories.

⁴⁵ Letter, Col. Larry B. McAfee, MC, Executive Officer, Office of The Surgeon General, 16 Jan. 1941, subject: Corps Area and Department Laboratories.

⁴⁶ See footnote 18(1), p. 431.

became service commands, and the laboratories accordingly became the service command laboratories.⁴⁷

The corps area laboratories which were established in 1941 were activated in the following locations: I Corps Area, Fort Devens, Mass.; II Corps Area, New York, N.Y.; IV Corps Area, Fort McPherson, Ga.; V Corps Area, Fort Benjamin Harrison, Ind.; VI Corps Area, Fort Sheridan, Ill.; VII Corps Area, Fort Omaha, Nebr.; VIII Corps Area, Fort Sam Houston, Tex.; and IX Corps Area, Fort Lewis, Wash., and Presidio of Monterey, Calif. As already mentioned, the II Corps Area Laboratory in New York was already serving in 1941, and the III Corps Area Laboratory activity was assumed by the Army Medical School in Washington. In 1942, their designations became Service Command Laboratories (map 10).

The 15 August 1941 letter⁴⁸ was more than a charter for these laboratories, since it defined their functions in relation to the Army's program in preventive medicine. They were to perform epidemiological, sanitary, and supplemental laboratory work required for field units located in their respective service commands. A review of the responsibilities of these laboratories makes it quite apparent why AR 40-305 contained certain specific provisions regarding the location of the laboratory, its administrative relationships within the command to the War Department, and the assignment and duties of laboratory personnel. The laboratories were to be staffed and equipped to investigate epidemics or other unusual disease conditions either on the basis of their own laboratory or epidemiological observations or on call from the service command or department surgeon.

Well-conceived and comprehensive as this plan was, it could be anticipated that proper function of these laboratories would require constant guidance and support from the Laboratories Division and other divisions of the Preventive Medicine Service in the Surgeon General's Office. Before the war, few physicians had the type of training and interest required to understand the concept of the military counterpart of the public health laboratory. Rapid expansion of medical facilities made it impossible to train, before their assignment, medical and other officers who were to staff the service command or department laboratories. The same might be said for the medical and medical general laboratories, all of which were destined for overseas theaters, and which were essentially counterparts of the service command and department laboratories. The proposed four medical general laboratories, 19 medical laboratories, and 12 service command and department laboratories, required more than 300 laboratory officers, underlining the problem of recruiting and selecting officers for responsibilities in great part new to them.

The corps area and department laboratories were to be prepared to conduct field surveys and to collect and examine possible agents responsible

⁴⁷ See footnote 18(2), p. 431.

⁴⁸ See footnote 18(1), p. 431.

for the infectious diseases of man and feed-animals. For these responsibilities and others to be mentioned later, the commanding officer had to possess a thorough knowledge of epidemiological and public health laboratory procedures. The particular qualifications of other officers required in these laboratories also were defined in the 15 August 1941 letter.

Through close communication with the surgeon of a command and his preventive medicine officer, the commanding officer of a laboratory was to be kept apprised of disease and sanitary conditions in the military and civilian populations of the command. This would demand close liaison also with the U.S. Public Health Service representative serving in a command.

Epidemiological activities were to be coordinated with the Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army which had been established in January 1941. Laboratory work concerned with sanitation at Army posts was to be carried out by service command laboratories for installations not prepared to do their own water bacteriology, chemistry, examination of food products and food handlers, or work on entomological and toxicological problems.

The mission of the service command and department laboratories also required them to supplement hospital laboratory services. All clinical diagnostic work was to be conducted by hospitals in their own laboratories, the scope of work being determined by hospital size and location. When tests had to be performed which were outside the scope of work permitted a hospital laboratory, these area laboratories were expected to assist. For example, hospitals of fewer than 1,000 beds were to refer specimens for Wassermann and other complement-fixation tests to the area laboratories.

The 15 August 1941 letter also urged that the commanding officers of the laboratories be regarded and utilized as laboratory consultants for the command. As such, they were encouraged to visit and inspect all diagnostic laboratories in the command and to maintain direct communication between such laboratories and the command laboratory. Because of these responsibilities, the staff of a command laboratory was to be composed of the most competent officers available. Although the commanding officers of the laboratories and their chiefs of divisions were assigned by the War Department, other commissioned, enlisted, and civilian personnel were to be assigned by the area commands.

The laboratories were encouraged to use standard items of equipment and supply insofar as possible. When needed, nonstandard items could be requisitioned. Motor vehicles were assigned to the laboratories, and it was stipulated that the corps area and department laboratories should have available on short notice, without delay and with the necessary drivers, one passenger car, one station wagon, and one 1-ton truck. A standard form of monthly report was contained in the 15 August 1941 letter. Monthly reports were to be rendered through the corps area or department surgeon directly to the Surgeon General's Office.

Reference is made in several portions of this chapter to some of the difficulties encountered in implementing the provisions of the 15 August 1941 letter and the 1942 regulation establishing the service command laboratories.⁴⁹ For reasons not always apparent, there was reluctance or difficulty on the part of commanding officers and command surgeons to utilize service command laboratories as prescribed. There were occasions when officers in these laboratories were assigned duties on a military post unrelated to the laboratory's mission, when transportation required by the laboratory was not provided by the command, when items of nonstandard equipment needed for special laboratory work were not approved by the command, and when the medical and surgical consultants of a command chose to deal directly with the Surgeon General's Office on laboratory matters rather than with the commanding officer of the laboratory.

Summary Review of Operations

First Service Command Laboratory.—Originally planned as a corps area laboratory at Fort Devens, the First Service Command Laboratory was located ultimately in Jamaica Plain, Mass., a suburb of Boston. It was established on 19 July 1941, under the command of Col. Paul A. Schule, MC. He was assisted by three officers, Capt. (later Maj.) Edgar J. Staff, SnC, bacteriologist; Capt. Floyd C. Votaw, VC, chemist; and 2d Lt. (later Capt.) Harry H. Laidlaw, Jr., SnC, entomologist. During the period when this laboratory was being organized, considerable assistance in serological testing was given by laboratories of the Health Department of the State of Massachusetts, then directed by Dr. Elliott S. A. Robinson. The role which these State laboratories played in the early days of the war is discussed later in this chapter.

The volume of work conducted in the Department of Serology of this laboratory is indicated by the figure of 45,457 examinations performed during 1944. Of these, more than 42,000 were serodiagnostic tests for syphilis. Other diagnostic work in this department included the identification of *Shigellas* and *Salmonellas*. Most of the work in the Department of Chemistry concerned food analyses for the Quartermaster Department and the service command veterinarian. Little clinical laboratory work was referred to this laboratory, since many of the dispensaries in the Boston area were being served by the adjacent Army hospitals.⁵⁰

Second Service Command Laboratory.—Located in the Federal Office Building at 90 Church Street, New York, N.Y., the Second Service Command Laboratory had a staff of eight officers under the command of Col. Frederick H. Foucar, MC. The 1944 annual report of this laboratory noted

⁴⁹ See footnote 18 (1) and (2), p. 431.

⁵⁰ Annual Report, First Service Command Laboratory, 1944.

that 1944 was its 25th year of operation. It was established as the Department Laboratory, Department of the East, in 1919.

It is apparent immediately that broader responsibilities were assigned to this laboratory than to the First and to some of the other service command laboratories. The number of procedures for 1945 totaled 633,900. The laboratory had the following sections: Histopathology, Bacteriology, Chemistry, Veterinary, Serology, Industrial Hygiene, Outpatient, and Medical Supply (fig. 51). In addition to supporting the many Army medical activities in the command, the laboratory also served U.S. Navy and Army Air Forces installations. For example, much of the laboratory work of the Navy Dispensary, housed in the same building, was done in Colonel Foucar's laboratory. The staff of the laboratory, in addition to handling the considerable volume of work forwarded to it, was active also in investigating diarrheal disease, food poisoning, and other problems in the field. The Histopathological Section of the laboratory examined about 4,000 specimens per year and prepared almost 20,000 microscopic slides. It maintained a teaching file of 2,000 photographs and 1,000 lantern slides. In addition to its service and training activities, the laboratory provided many diagnostic biologicals and other laboratory materials to medical activities in the New



FIGURE 51.—Portion of the Serology Section, Second Service Command Laboratory, New York, N.Y.

York area. Often the laboratory was called upon to ship supplies to overseas units.

The Meritorious Service Unit Plaque was awarded to the Second Service Command Laboratory on 30 November 1945, under General Orders No. 109, Army Service Forces, Headquarters, Second Service Command.

Third Service Command Laboratory.—The functions of the Third Service Command Laboratory were performed by the Army Medical School, Army Medical Center, Washington, D.C.

Fourth Service Command Laboratory.—The Fourth Service Command Laboratory had its origin in the corps area laboratories established by the letter dated 15 January 1941, "Corps Area and Department Laboratories." Maj. (later Col.) Dwight M. Kuhns, MC, was ordered to organize the staffing of the laboratory, which was activated on 21 October 1941, at the Station Hospital, Fort McPherson, Ga. Major Kuhns continued in command until 3 November 1943, having been promoted to lieutenant colonel on 1 February 1942, and to the grade of colonel on 16 March 1943. Maj. Jerome S. Harris, MC, commanded the laboratory from the time of Colonel Kuhns' departure until the arrival of Col. Loren D. Moore, MC, on 13 December 1943. Colonel Moore went on terminal leave on 4 August 1945, and was succeeded by Col. Virgil H. Cornell, MC, on 21 September 1945.

Upon completion of new facilities at Fort McPherson, the service command laboratory was transferred from the station hospital. During its early work in the field, the laboratory staff made wide use of a van-type laboratory truck to investigate outbreaks of diarrheal disease, postvaccinal jaundice, and meningococcic meningitis, among other diseases which proved disrupting, especially at the larger training centers.⁵¹ A second laboratory truck was added in May 1944. Among the laboratory officers who served with this unit were Capt. (later Maj.) Theodore G. Anderson, SnC; Maj. (later Lt. Col.) Stanley J. Carpenter, MSC; Capt. (later Maj.) Norman L. Cressy, MC; Capt. (later Maj.) Harry A. Feldman, MC; Major Harris; 2d Lt. (later Capt.) Harry Hoogstraal, SnC; Capt. L. Roland Kuhn, SnC; Capt. Norman C. Laffer, SnC; Capt. William C. Moloney, MC; Capt. (later Maj.) Carl T. Nelson, MC; Maj. Carl Olson, Jr., VC; Capt. (later Maj.) Edward F. Roberts, MC; Capt. (later Maj.) Horace W. Smith, MC; 2d Lt. (later Capt.) John Spizizen, SnC; Capt. (later Maj.) William C. Spring, MC; Maj. John C. Swartzwelder, SnC; Capt. Edwin O. Wicks, SnC; and Lt. Col. (later Col.) Harry E. Wright, MC. For outstanding contributions of his laboratory to the service command, Colonel Kuhns was awarded the Army Commendation Medal.

There was a continuous laboratory control and surveillance program for posts, camps, and stations which consisted of periodic examination of water supply, milk and other dairy products, and food; mess sanitation;

⁵¹ Annual Report, Fourth Service Command Laboratory, 1942.

and insect control. Diagnostic service of a wide variety included bacteriology, clinical microscopy, chemistry, venereal disease, veterinary medicine, and entomology. Particularly important was the program designed to improve the caliber of the medical laboratory performance throughout the command. This program included a wide variety of training courses for laboratory personnel. Laboratory proficiency evaluations consisted of distribution of specimens to laboratories in the command and an analysis of results reported by the laboratories. More than 100 stations in the service command participated in these proficiency evaluations. Conference trips by staff members to hospital laboratories were numerous and were invariably of mutual benefit. Training programs for technicians, conducted during the 3½ years of operation during the war, included more than 1,600 students taking more than 20 different types of laboratory courses (fig. 52). Unique among these were the courses in mycology and malariology.

A measure of the magnitude of the laboratory's activities is indicated by the number of laboratory personnel on duty. This averaged 20 Medical and Sanitary Corps laboratory officers during the peak periods of work, with more than 20 enlisted technicians and almost 30 civilian technicians during such periods.⁵²

The medical consultant for the Fourth Service Command, Col. Henry M. Thomas, Jr., MC, lauded the performance of the service command laboratory. His visits to the hospital laboratories were frequent, and he reported that many were not up to a proper level of performance because they were understaffed. He believed that the command should have a larger laboratory consultation service. In addition to the commanding officer of the service command laboratory, he advised that there also be a laboratory consultant, well-versed in clinical laboratory work, who might have a position as an assistant medical consultant, and who would be assigned to his office in the service command headquarters.⁵³

Fifth Service Command Laboratory.—Activated on 15 September 1941, at Fort Benjamin Harrison, Ind., the Fifth Service Command Laboratory was commanded by Colonel Holt. In 1944, the staff consisted of nine officers, usually more than 20 enlisted men, and 11 civilians. Of interest in the reports of this laboratory was the emphasis on the training of officer and enlisted personnel. Such training, to meet a variety of needs, was continued even though the size of the laboratory staff was not always up to the strength needed for both the service work and the training program. In his annual report for that year, Colonel Holt acknowledged the generous assistance of the commanding officer of Fort Benjamin Harrison. For example, when the laboratory staff was reduced to a seriously low level by the assignment of personnel to units leaving the command, the post

⁵² Annual Report, Fourth Service Command Laboratory, 1943.

⁵³ See footnote 24, p. 438.



FIGURE 52.—Training laboratory technicians at the Fourth Service Command Laboratory. (Top) Students examining the effects of chemicals in water on the toxicity of DDT. Note the trailer van laboratory on the left. (Bottom) Enlisted students in an entomology course dipping for mosquito larvae.

commander assigned 11 selected German prisoners of war to assist in the work of the laboratory.

The laboratory served the service command well through field trips to conduct surveys or inspections. These included housing surveys, laboratory inspections, evaluation of rodent and insect control, water supply, the use of DDT, and the like. The records show that the laboratory was in constant contact with the command hospitals, advising on the preparation of specimens and the performance of laboratory tests (fig. 53).

The number of specimens received per month ranged from fewer than 4,000 during the fall to almost 10,000 during the summer, and the number of examinations performed, from 9,000 to more than 18,000 per month.

An epidemiology section was established in 1944 under Capt. (later Maj.) William A. Davis, MC, who had served with the U.S.A. Typhus Commission. Studies under his direction included an investigation of trichinosis in German prisoners of war and a respiratory disease outbreak which proved to be caused by influenza virus, type B. Participants in this field investigation included 2d Lt. (later 1st Lt.) Mola M. Sigel, SnC, Margaret M. Hart, T. Sgt. Gerald Hobbs, and Beverly Guthner, who established the identification of influenza virus, type B, as the agent causing the



FIGURE 53.—Chemistry Section, Fifth Service Command Laboratory, showing the standard pattern designed for service command laboratories. (AFIP photograph.)

epidemic at Camp Atterbury, Ind.⁵⁴ Among other investigations carried out was a study of streptococci isolated from patients with scarlet fever who had been receiving prophylactic sulfathiazole. It was noted that the lack of response to the drug might be related to an acquired resistance of the bacteria to the sulfathiazole. These and other reports demonstrate the breadth of activity of this service command laboratory.

Sixth Service Command Laboratory.—Established on 4 February 1941, at Fort Sheridan, Ill., the Sixth Service Command Laboratory served on that post as a unit until November 1944. The unit was divided at that time, with the Veterinary Department remaining at Fort Sheridan and the other departments being transferred to the Gardiner General Hospital in Chicago. The commanding officer soon after the laboratory's activation was Col. Charles G. Sinclair, MC. Maintaining an adequate staff in each laboratory department must have been exceedingly difficult, since early reports indicate a very rapid turnover of both officers and enlisted men. One of the reports of that period mentions a 300-percent turnover in enlisted personnel and an 80-percent turnover in officers, making the constant training of personnel for all departments a necessity. The staff consisted of six officers while the unit was stationed at Fort Sheridan. Training was provided not only for the laboratory's own staff but also for the technicians who were assigned to the large unit training center at Camp Ellis. The largest volume of work was carried by the Veterinary Department because it served the Chicago Quartermaster Depot. For example, during 1943, there were 2,154 pathology examinations, 14,537 bacteriology examinations, 37,385 serologic tests, 13,098 chemistry examinations, and 45,371 veterinary tests, for a total of 112,545.⁵⁵

Stations in the service command were visited for epidemiological surveys or pest control investigations. Periodic evaluation of serologic tests was performed by the 13 stations in the Sixth Service Command which were authorized to carry out such tests. The early work of the service command laboratory was confined largely to these types of examinations, with little demand coming from the hospitals in the command. Later in the war, when the total volume of work in the service command laboratory declined, relatively more work was done for the hospitals. By comparison with other service command laboratories, the overall volume here was small. When the laboratory was transferred to the Gardiner General Hospital, it no longer functioned as a unit and had no commanding officer. Lt. Col. Irving Madoff, MC, had the designation, Chief, Sixth Service Command Laboratory. The records show that this laboratory, which was also a histopathologic center, was understaffed, as were many hospital laboratories in this service command. Pathologists in the larger hospitals were overburdened, had staffs too small to meet the demands of the hospital, and

⁵⁴ Annual Report, Fifth Service Command Laboratory, 1944.

⁵⁵ Annual Report, Sixth Service Command Laboratory, 1943.

"worked week after week until midnight in order to keep current with their work."⁵⁶

Seventh Service Command Laboratory.—Activated on 5 November 1941, at Fort Omaha, Nebr., the Seventh Service Command Laboratory served one of the largest geographic areas, and therefore had one of the largest staffs among these laboratories. Under Col. J. Vincent Falisi, MC, its commanding officer for most of the war, there were 12 officers, nine enlisted men, and 33 civilians. Maj. Myron N. Jorgensen, SnC, was in charge of chemistry; Capt. Robert A. MacCready, MC, bacteriology; 1st Lt. Hugh L. Keegan, SnC, entomology; 1st Lt. (later Capt.) Morris D. Schneider, VC, veterinary activities; and 2d Lt. (later 1st Lt.) Virginia B. Hartridge, WAC, serology. The number of procedures performed by the Veterinary Department outnumbered those in every other department, with a total of 188,000 during 1944. Compared with this were 136,000 for entomology, 102,000 for serology, 78,000 for bacteriology, and 62,000 for chemistry. Visits to hospital laboratories by the staff members were numerous. There were 60 hospitals in the command, only 25 of which were reported to have full-time laboratory officers. This gives some indication of the amount of clinical laboratory work which had to be performed by the command laboratory. All of the laboratories served by the command laboratory participated in the performance evaluation studies.⁵⁷

At the time of its official activation, this laboratory was under the command of Maj. (later Col.) Francis E. Council, MC. When Colonel Council departed for duty in the Pacific in March 1942, Colonel Falisi assumed command and remained until the end of the war. Originally standard in design, the laboratory's design and area were altered as it became necessary to expand its operations to accommodate more work. These modifications were undertaken with the full support of the service command surgeon and the headquarters.

Eighth Service Command Laboratory.—Established on 15 March 1941, at Fort Sam Houston, Tex., the Eighth Service Command Laboratory also served one of the larger geographic areas containing many training activities with large numbers of troops and many Medical Department installations. Despite an enormous volume of work, the staff pursued an admirable program of investigation, with many studies resulting in outstanding research publications. The commanding officer was Lt. Col. (later Col.) Harvey R. Livesay, MC; the chief of the Bacteriology Section, Capt. (later Maj.) Henry B. Webb, MAC; Serology, Maj. (later Lt. Col.) William F. Hettler, MSC; Chemistry, 1st Lt. (later Maj.) Victor I. Lyday, MC; Veterinary, Maj. (later Lt. Col.) Morris Pollard, VC; and Entomology, 1st Lt. (later Maj.) Theodore A. Olson, SnC.

The training program for officers and enlisted men was an active one,

⁵⁶ See footnote 24, p. 438.

⁵⁷ Annual Report, Seventh Service Command Laboratory, 1944.

with officers being sent to universities and research laboratories for special training. Particular emphasis was placed on the study of endemic typhus fever in Texas. Investigation of so-called Bullis fever occupied the laboratory for a considerable period. The Bacteriology Section was busy with numerous opportunities to study diarrheal disease. Although there was a considerable volume of work in water and food chemistry, the Chemistry Section also served many of the hospital laboratories.

Following a visit to the laboratory by Colonel Bauer, medical consultant for the Eighth Service Command, and Dr. Chester W. Jones, professor of medicine, Harvard Medical School, a plan for additional assistance to the hospitals in the command was devised. It was agreed that the chief of each hospital laboratory should visit the service command laboratory at least once a year for 1 week or more on temporary duty. Resulting from this arrangement, and in response to requests from Colonel Bauer, support for the hospital laboratories was further broadened.

During 1944, more than 400,000 laboratory procedures were performed by this laboratory. In 1945, the volume of work continued high. There was continued progress made in the study of the Rh factor, the Rh typing of erythrocytes, and the identification of Rh antibodies. A Streptococcus typing program was established by Maj. (later Lt. Col.) Roger D. Reid, SnC. The agent in an epidemic of viral influenza was proved by the laboratory to be type B.

Of interest from the Bacteriology Section was the report that *Salmonella pullorum* could produce infection in man. This was observed in 16 soldiers newly arrived at Randolph Field, Tex., who had come from Illinois, where it was believed that the infection had been contracted from eating rice pudding made with contaminated eggs.

Colonel Bauer's interest in autopsy protocols was welcomed by the service command laboratory and also in the Surgeon General's Office by the Medical Consultant and Laboratories Divisions. Three copies of each autopsy protocol were sent to the service command surgeon, one of which went to Colonel Bauer's office where it was reviewed and corrective action taken when necessary. General Morgan, Chief Consultant in Medicine to The Surgeon General, encouraged this procedure and advised its adoption by all service commands. The assistance which Colonel Bauer obtained from outside sources for the training program in the Eighth Service Command is cited elsewhere in this chapter.

Ninth Service Command Laboratory.—Serving the largest of the commands, the Ninth Service Command Laboratory consisted of two units, one at Fort Lewis, Wash. (fig. 54), and the other at the Presidio of Monterey in California.

The Fort Lewis laboratory unit was activated on 6 June 1941, and until March 1944 it remained an independent activity functioning under the jurisdiction of the Ninth Service Command surgeon. In March 1944,



FIGURE 54.—Fort Lewis branch of the Ninth Service Command Laboratory. One wing of the standard H-shaped design is shown.

the laboratory was merged with the station complement of Fort Lewis, Wash., and in October 1944, it was placed under the jurisdiction of the Commanding Officer, Madigan General Hospital, Fort Lewis. Its four major sections were: Bacteriology, Chemistry, Serology, and Veterinary. Much of the work in bacteriology was devoted to the identification of enteropathogenic bacteria, the typing of meningococci, and surveys of field units. Bacteriology was responsible also for the diagnosis of malaria and other parasitic infections. Surveys for intestinal helminths and protozoa occupied much of the time of this unit beginning with the arrival of large numbers of foreign prisoners of war in this service command. During the most active period of this unit's operation, Maj. Bernard S. Henry, SnC, was in charge.

Maj. Victor E. Levine, supervised the Chemistry Section and was assisted by 2d Lt. (later 1st Lt.) Russell T. Nelson, SnC. After the laboratory became a unit under Madigan General Hospital, Major Levine became Chief, Ninth Service Command Laboratory. A great bulk of the Chemistry Section's work consisted of meeting requests from the hospital laboratories for standard solutions, water chemistry, toxicological examinations, and other types of special analyses.

The Serology Section was directed by 2d Lt. (later 1st Lt.) Annis O. Wilkerson, WAC. As in other service command laboratories, the volume of work was large and included not only the testing of specimens but also the proficiency evaluation of other laboratories in this geographic area.

Capt. Phillip C. Manly, VC, supervised the Veterinary Section, which was responsible for chemical and bacteriological examinations of food and food products, and the breeding and care of laboratory animals used in various sections of the laboratory.

This laboratory was housed in the standard-type structure designed for service command laboratories. However, modification of the standard scheme was necessary because the Veterinary and Chemistry Sections

required more space than originally planned. During the most active period of this laboratory's service, it had no commanding officer. Administrative action had placed the unit under the command of the Madigan General Hospital, eliminating the need for a commanding officer for this branch of the service command laboratory. As noted previously, this occurred also in the Sixth Service Command. For a short period, Colonel Council had the designation of Chief, Ninth Service Command Laboratory Branch. He was assisted by Lt. Col. Perry T. Hough, MC, Executive Officer, who supervised the administrative, personnel, and training sections. As will be noted in the history of the 29th Medical Laboratory, Colonel Hough was to command that unit, supervise its training at Fort Lewis, and then take the unit to the India-Burma Theater.

The average number of enlisted men at this branch of the command laboratory was 10, as was also the average number of civilians. During 1944, 60,000 examinations were performed by the laboratory, the bulk of these being carried out by the Bacteriology Section in a parasitic diseases survey of foreign prisoners of war. Of the prisoners, 3,500 were German, 630 were Italian, and 100 were Russians who had served with German troops. Of the German prisoners, 2,600 had been members of the *Afrika Korps* and had been in the United States for many months. A rapid survey method of stool examination showed *Trichuris trichiura* to be the commonest parasite. In the Italian service troops, the percentage with trichuriasis was 37, in the Russians it was 29, in the Germans transferred from France it was 12, and in those from North Africa, it was 7. The presence of *Ascaris lumbricoides*, which was found in 22 percent of the Russians transferred from France, was unusually high. This group also had the highest percentage of isolation of *Endamoeba histolytica*; namely, 15 percent.

The Ninth Service Command Laboratory unit at the Presidio of Monterey was activated on 1 January 1942. This location proved to be unfortunate because of the relative isolation of the Presidio. There were delays in receiving specimens by mail and delays in receipt of reports by the installations shipping specimens to the laboratory. The alternative location for the laboratory had been Fort Ord, Calif., and, in retrospect, this would have been a more suitable site. Again, the buildings housing this laboratory were of standard design, but they required modification as the work increased. The laboratory was a separate unit until February 1944, when it became a component of the Presidio of Monterey.

Col. James P. Crawford, MC, was the commanding officer, and Maj. (later Lt. Col.) Theodore W. Keiper, SnC, was executive officer and chief of the Serology Section. 1st Lt. (later Capt.) Alfred L. Florman, MC, was chief of the Bacteriology and Virus Section (fig. 55); Capt. John E. Craige, VC, was in charge of the Veterinary Section; and Capt. Evans N. Sakellariou, SnC, supervised the work in chemistry. In most respects, the work

resembled that conducted by other service command laboratories. As area reference laboratory for the diagnosis of malaria, all blood films on which this diagnosis had been made were reexamined here.

Under Col. Verne R. Mason, MC, the service command medical consultant, rheumatic fever centers had been established. This resulted in the collection of great numbers of specimens for isolation of streptococci, their grouping and typing, and also the performance of antistreptolysin titrations. Considerable assistance in arranging these rheumatic fever studies came from Dr. Lowell A. Rantz who was working with the Commission on Hemolytic Streptococcal Infections of the Army Epidemiological Board.

Of particular interest was the expansion of the Virus Section during 1944. Under Captain Florman, considerable work on the diagnosis of influenza, atypical pneumonia, and encephalitis was carried out. Epidemic influenza was identified in this area as type A. In this and other studies, the laboratory worked closely with the commissions of the Army Epidemiological Board and also with the Division of Virus and Rickettsial Diseases of the Army Medical School. Captain Florman had a short tour of duty in this Army Medical School division, where he worked with Col. Harry Plotz, MC, and his staff. There were also visits to the Monterey laboratory by Army Epidemiological Board representatives, including Drs. Monroe D. Eaton, Karl F. Meyer, and William McD. Hammon.

Although this laboratory might have served the command better had it been stationed at Fort Ord, it is apparent from reports and publications that it served well at its Monterey location and was able to undertake a number of valuable investigative studies.

Department Laboratories

The Panama Canal Department, with its headquarters at Quarry Heights in the Canal Zone, was established on 1 July 1917. The surgeons who directed medical activities of the department during the war years were Col. John W. Sherwood, MC (1941-43), and Col. Wesley C. Cox, MC (1943-45). The other medical activity in the Canal Zone, which dates back to 1904, was founded by Colonel Gorgas, as a Department of Sanitation. In 1914, this became the Health Department of the Panama Canal. This department was headed by Col. (later Maj. Gen.) Morrison C. Stayer, MC, its chief health officer from 1939 until 1944.

Medical activities expanded rapidly even during the "limited national emergency," when the headquarters of the Caribbean Defense Command was established in Panama. The War Department authorized the Caribbean Defense Command on 9 January 1941, and it was activated on 10 February 1941.

The most active of the hospitals under the department surgeon was the 262d General Hospital at Fort Clayton. Range and volume of work indicate

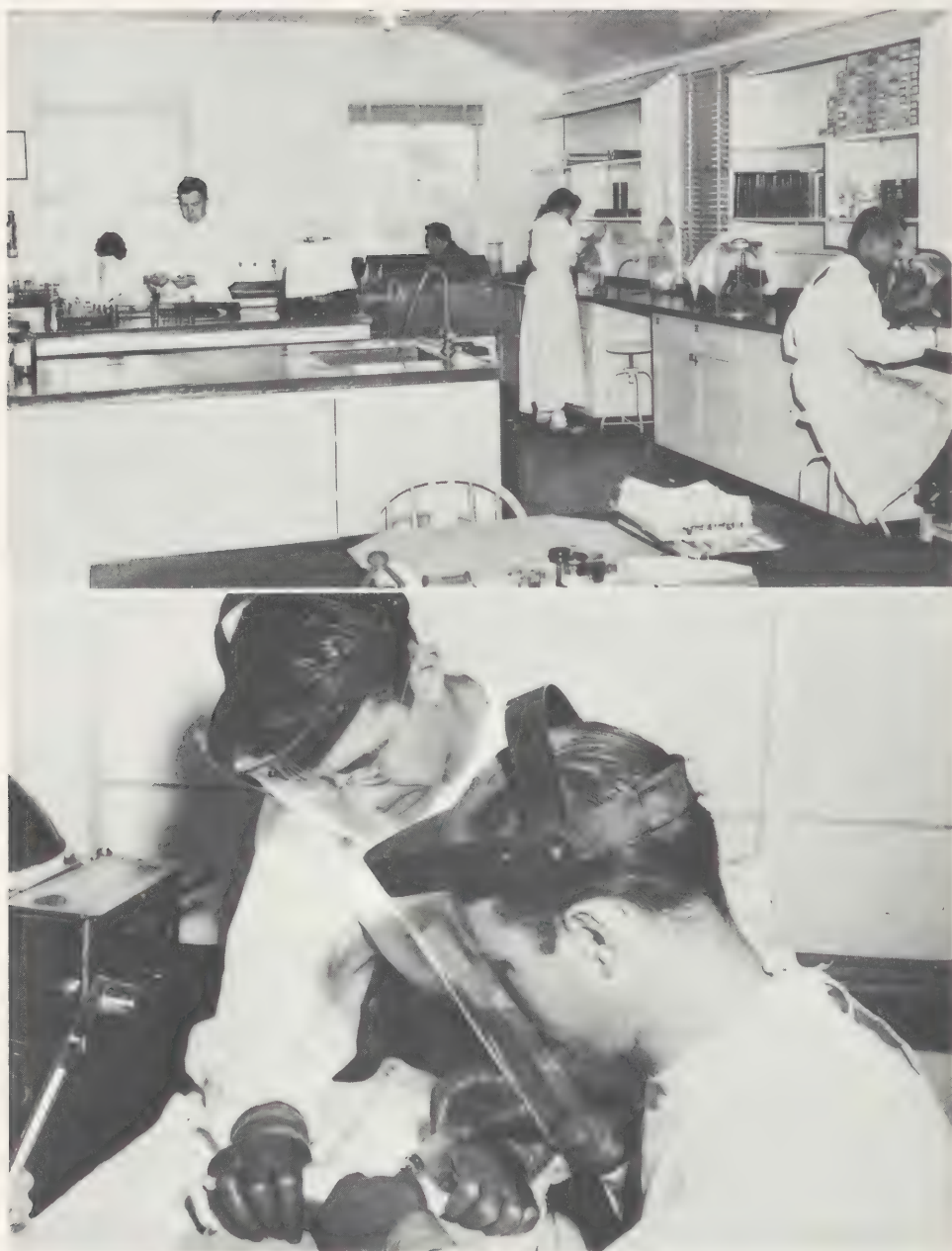


FIGURE 55.—Bacteriology and Virus Section, Presidio of Monterey branch of the Ninth Service Command Laboratory. (Top) The layout of this section was a standard design for all service command laboratories. (Bottom) This section was active in virus diagnostic and research work. Illustrated are the precautions observed in handling specimens suspected of containing a viral agent.

that the 262d General Hospital had a well-staffed and well-equipped laboratory.⁵⁸ The publications of Jenkin and Cox describe in detail the clinical laboratory studies conducted independently at the 262d General Hospital, as well as those investigations which were carried out jointly with the Gorgas Hospital. Together, the Gorgas Hospital and the adjacent Board of Health Laboratory served the Panama Canal Department as a department laboratory. Rapid progression of mobilization forestalled plans for construction of the department laboratory which had been authorized for the Canal Zone.

In August 1944, Puerto Rican troops stationed in Panama were examined for evidence of schistosomiasis by the 262d General Hospital laboratory staff. Fifteen percent of the 1,000 tested had positive skin tests to cercarial antigen. When comparable groups of reactors and nonreactors had fecal specimens examined for schistosome eggs, 40 percent of the reactors to cercarial antigen had positive stools. However, among the nonreactors, 12 percent had positive stools. Thus, the cercarial antigen used lacked both specificity and sensitivity. Comparison with the data collected by the Puerto Rican Department Laboratory, presented below, indicates that the percentage of Puerto Rican soldiers with positive stools was higher in Panama than in Puerto Rico. The figure of more than 20 percent obtained in Panama was on the basis of five stool examinations, whereas in the study of Selective Service registrants in Puerto Rico, only a single stool specimen was examined. Positives in Puerto Rico amounted to 10 percent. Panama had no known endemic foci of schistosomiasis.

A survey for filariasis among Puerto Rican troops in Panama yielded 1.1 percent positives among 14,863 examined in 1944 and 1945. Bancroft's filariasis was endemic in Puerto Rico but not in Panama.

Studies in 1945, involving the Army's hospitals, the laboratories of the Gorgas Hospital, and the Board of Health Laboratory, included the identification of clinical Q fever and influenza type B virus infections. Of particular epidemiological interest was an upsurge in the common contagious diseases, following the arrival of Puerto Rican troops. The increase in chickenpox, mumps, and German measles was limited almost entirely to the Puerto Rican troops.

Hospitals other than the 262d General Hospital also shared in the experience just described. Although there were two other general hospitals, the 210th and 218th, only two of these three hospitals served as general hospitals at any one time. The 210th was the former 368th Station Hospital, and the 218th became the 333d Station Hospital. Unusual in the experience of the 210th General Hospital were the relatively large numbers of cases of amebic liver abscess, primary atypical pneumonia, and relapsing fever.

⁵⁸ (1) History of Medical Department Activities in the Caribbean Defense Command in World War II, vols. I-III. [Official record.] (2) Professional History of Internal Medicine in World War II, 1 January 1940-1 October 1945, The Panama Canal Department, vol. II. [Official record.]

Another important activity stationed at Fort Clayton was the Army School of Malariology. Authorized in September 1943, its program was developed by the Training Division, Preventive Medicine Service, and the Sanitary Engineering Division, SGO.⁵⁹

The Army had proudly observed the progress made by the Canal Zone-based Army Medical Research Board during the years just before World War II, under the presidency of Colonel Simmons in 1938 and 1939. This independent installation, devoted entirely to research, was the only one of its kind in the Army. The Surgeon General, in his report for fiscal year 1939, cited the board's studies of malaria and its attempts to propagate *E. histolytica* and other protozoa in pure culture in order that their antigens could be characterized and the immune response of the mammalian host better understood. Relationships between *Trichomonas vaginalis* (human) and *Trichomonas foetus* (bovine) were investigated as were sulfanilamide efficacy in the treatment of bovine brucellosis, filariasis in man and dogs, degenerative arthritis, and factors in epidemic diarrheal disease. It was unfortunate that in fiscal year 1940, when an expanded research program concentrating on the problems of this important tropical area would have been both timely and appropriate, the Army Medical Research Board was discontinued because of a lack of funds. Of some satisfaction to those who urged support for research was the announcement in the 1940 annual report of The Surgeon General that the Army's funds for medical research were to be increased from \$16,000 for 1940 to \$37,000 for 1941.

Of the four department laboratories planned, only one had a building designed and constructed for its use; namely, the Puerto Rican Department Laboratory. Construction of this laboratory was begun in June 1941, and the building was completed and occupied on 26 December 1941 (fig. 56). The Puerto Rican Department Laboratory was located in San Juan, P.R., adjacent to the School of Tropical Medicine. A letter announcing the opening of the laboratory was distributed on 26 February 1942, and the first specimens were received on 1 March.

The laboratory was designed in early 1940 in the Preventive Medicine Subdivision of the Surgeon General's Office by Colonel Simmons, Major Stone, and Colonel Cornell, who was to be the commanding officer. Colonel Cornell arrived in Puerto Rico early in 1941 and was joined in July by 1st Lt. Gustave J. Dammin. During the interval before the opening of the laboratory, Colonel Cornell and Lieutenant Dammin conducted venereal disease surveys, visited the malarial foci, and familiarized themselves with the medical facilities, particularly those in which patients with diarrheal disease might be hospitalized. A laboratory at the School of Tropical Med-

⁵⁹ (1) Disposition Form, Maj. Gen. Thomas T. Handy, Assistant Chief of Staff, G-3, to Commanding General, Army Service Forces, 29 Sept. 1943, subject: Army School of Malariology (Canal Zone), and 1st indorsement thereto. (2) McCoy, Oliver R.: War Department Provisions for Malaria Control. In *Medical Department, United States Army. Preventive Medicine in World War II. Volume VI. Communicable Diseases: Malaria*. Washington: U.S. Government Printing Office, 1963, ch. II.



FIGURE 56.—Puerto Rican Department Laboratory, as it appeared on completion in 1941.

icine had been conducting studies of diarrheal disease in the civilian population. These studies were sponsored jointly by the school and by the U.S. Public Health Service. The latter agency had assigned Dr. Albert V. Hardy and Dr. James Watt to the school to establish an enteric diagnostic laboratory. With this group, members of the Puerto Rican Laboratory surveyed military installations reporting diarrheal disease. This provided an opportunity to become familiar with newer methods for such surveys and to establish, through joint studies, the efficacy of sulfaguanidine in mass prophylaxis against *Shigella* infection and bacillary dysentery. The shigellae isolated during this period proved to be sensitive to the sulfonamides.

The new building proved to be satisfactory in many ways, but it was found very early that space for housing animals was inadequate and space for storing supplies was too limited. The location of the building on the shoreline created problems, many of which resulted from the high humidity and ocean spray. Instruments with electrical circuits were subject to rapid deterioration unless given special care. Because of its exposed location, the building was vulnerable to damage from rainstorms and salt spray, since its windows had not been designed to withstand heavy weather of the type encountered on Puerto Rico's northern coastline.

Officers on duty during 1942 included: Colonel Cornell, Commanding

Officer; Captain Dammin, Bacteriology and Serology; Capt. Sidney Kaye, SnC, Chemistry; Capt. (later Maj.) Thomas H. G. Aitken, SnC, Entomology; and 1st Lt. (later Capt.) Thomas H. Weller, MC, Parasitology.

The laboratory instituted a delay darkfield service. Specimens from suspected syphilitic lesions were collected in capillary tubes and sent to the department laboratory for darkfield diagnosis. Slides of stained smears of *Corynebacterium diphtheriae* and *Mycobacterium tuberculosis* were distributed to the laboratories in the command for training purposes. The laboratory's role in malaria control required many visits to field installations for both parasite and mosquito density surveys. To determine more readily the origin of malaria cases and the total number of cases at any one time, Lieutenant Weller designed a malaria case card which proved to be of inestimable help to the laboratory, to the hospitals, and to the Puerto Rican Department surgeon.

The laboratory studied or assisted in identifying cases of endemic typhus, lymphocytic choriomeningitis, schistosomiasis, hepatitis, and infectious mononucleosis. In a survey of military personnel for amebic infection, involving more than 1,500 specimens, only 2 percent were found positive for *Entamoeba histolytica*.

In 1943, the laboratory became the Antilles Department Laboratory. Additional space was awarded for animal quarters, and rearrangement of the laboratory afforded more space for special studies, such as those which were carried out in 1943 with Dr. (later Lt. Col.) John H. Dingle and Dr. Alto E. Feller of the Army Epidemiological Board's Commission on Acute Respiratory Diseases. In December 1942, as plans for this study were being made, and a survey of 20,000 Selective Service registrants for intestinal helminths was undertaken, Colonel Cornell departed to command the 15th Medical General Laboratory. This left the department laboratory with only two medical officers, Captain Dammin and Lieutenant Weller. As the laboratory's workload increased, the shortage of personnel made it necessary to curtail visits to field installations. No replacement was sent for Colonel Cornell, and Major Dammin assumed command in February 1943.

For the survey of Selective Service registrants, a new method of concentration of the fecal specimen was devised.⁶⁰ This method proved to be particularly helpful in the separation of schistosome eggs. Selective Service had determined that the presence of schistosome infection would be the basis for rejection of the registrant. On the basis of laboratory findings, approximately 10 percent of the registrants were not acceptable for military duty although they had met Selective Service physical standards.

Dr. Dingle and Dr. Feller joined the laboratory in July 1943 to study

⁶⁰ Weller, T. H., and Dammin, G. J.: The Acid-Ether Centrifugation and the Zinc Sulfate Flotation Techniques as Methods for the Recovery of the Eggs of *Schistosoma mansoni*. Am. J. Trop. Med. 25: 367-374, July 1945.

the mongoose as an animal host possibly susceptible to the agent or agents causing primary atypical pneumonia. Mongooses were trapped in various parts of the island and shipped to the laboratory. They were inoculated with the test materials brought from Fort Bragg and examined for pulmonary infection. It was soon learned that unless the mongoose lung was handled with great care, it could manifest alterations which, as artefacts, could be misinterpreted as pulmonary lesions. It was neither possible to induce clinical illness in the mongoose nor to produce lung alterations which could be identified as an infectious process.⁶¹

The Hawaiian Department Laboratory provided the staff for the 14th Medical Laboratory, as recorded later in this chapter. When the 18th Medical General Laboratory arrived on Oahu, Territory of Hawaii, in August 1944, a department laboratory was no longer needed.

Plans for a department laboratory in the Philippines never materialized because of enemy action. Until the beginning of hostilities, the Sternberg General Hospital in Manila had its laboratory provide the services of a department laboratory.

HOSPITAL LABORATORIES

Preparation and Development

During 1940, estimates were made of the number of laboratory specialists required by the hospitals for the impending mobilization. It should be remembered that some of the larger military hospitals, as independent installations, have much broader responsibilities assigned to their laboratories than are assigned to laboratories in civilian hospitals of comparable size. The Army hospital laboratory serves not only inpatient and outpatient populations but also the military post of which it is a unit with such services as water bacteriology and chemistry. The laboratory in a hospital which functions also as a regional hospital is expected to support smaller hospitals and other types of medical units, such as dispensaries. Thus, the laboratory of the Army hospital must be larger than that of a civilian hospital serving a patient population of the same size.

The prewar civilian hospital had no counterpart of the Sanitary Corps laboratory officer. Thus, there was no reservoir of scientists which could be tapped as a source of this important category. As already recorded in this chapter, prerequisites for commissioning in the Sanitary Corps were established early in the war because of the projected large requirement for these scientists. The number of Medical Corps laboratory officers available for assignment early in the war was small, but the pathologist assigned to an Army laboratory required little orientation and his adjust-

⁶¹ (1) Report, Antilles Department Laboratory, 28 Dec. 1943. (2) Commission on Acute Respiratory Diseases: Attempts to Transmit Primary Atypical Pneumonia and other Respiratory Tract Infections to the Mongoose. *J. Immunology* 50: 107-114, February 1945.

ment to his new position was rapid. Because of this, he was in a position to guide the Sanitary Corps laboratory officer in his adaptation to the medical laboratory environment.

Physical facilities required for each type of hospital laboratory were reviewed by Colonel Simmons with the chief of hospital construction in April 1941. Whatever criticism there may have been of these plans, none received attention until the latter years of war when it was found that, as the census and work of a hospital increased, there was insufficient flexibility in the laboratory area to allow for expansion.

An important step was taken in developing hospital laboratories with the publication of OTSG Circular Letter No. 73, "Provision of Adequate Laboratory Services in Military Hospitals," dated 22 July 1941, which pertained to the needs of the laboratories and provided a guide to laboratory service in relationship to hospital size. This letter requested information from the commanding officer of each hospital and dispensary on the adequacy of his laboratory facilities and also requested his recommendations on modifications needed for improvement of the facilities. Tables which accompanied the circular letter designated the procedures to be performed in laboratories of various sizes and also served as a guide for the assignment of commissioned and enlisted personnel to laboratories.

Training programs for laboratory officers were established in 1942 as the result of a congressional amendment in that year to the National Defense Act of 1920. Clinical laboratory instruction was given in courses of 12 weeks' duration. During 1943 and 1944, a total of 464 officers were graduated from such courses given at the following schools: University of Chicago, Columbia University, Duke University, Johns Hopkins University, University of Michigan, University of Minnesota, Ohio State University, University of Oregon, University of Pennsylvania, and University of Tennessee. Although these courses were designated primarily for Medical Corps laboratory officers, Sanitary Corps laboratory officers also were assigned to them.

The growing number of hospitals in 1941 made it apparent that the Army Medical Museum would be forced to decentralize its program of services to hospitals. A plan for such decentralization was devised by Colonel Ash, Curator of the Army Medical Museum, Major Stone, and Capt. (later Lt. Col.) Thomas G. Ward, MC, of the Sanitation, Hygiene, and Laboratories Division. It was published in December 1941 as a circular letter which announced the establishment of 19 installations to serve specified geographic areas as histopathologic centers (pp. 434 and 451-458). Instructions were given on the preparation of specimens for shipment to the centers. The definitive plan for the histopathologic centers was released later in War Department Technical Bulletin (TB MED) 19, dated 11 March 1944, "Facilities Provided for Tissue Pathology in U.S. Army." In this plan, the Army Medical Museum was relieved of responsibility as

a histopathologic center, because by this time, its consultative, training, and research activities had burgeoned as had its responsibilities for the overall program for pathology in the Army.

Although many guides had been issued to define the types of laboratory work permitted in various types of installations, differences of opinion persisted and questions were raised about the propriety of performing a particular test in a particular laboratory. This was clarified greatly by the publication, in January 1945, of TB MED 135, which concerned the function and scope of Medical Department laboratories. The lists contained in this technical bulletin were prepared through prolonged consultation with the Medical Consultants Division of the Professional Service. As mentioned earlier, the medical and surgical consultants were still reluctant to accept medical laboratory activities as a part of preventive medicine. However, the clinical consultants were cooperative, and the medical consultants often assisted in evaluating the performance of hospital laboratories. These evaluations were of great help to the Laboratories Division in the Surgeon General's Office. In some of the larger service commands, more useful information regarding the performance of a hospital laboratory came from the medical consultant of the service command than from the commanding officer of the service command laboratory (pp. 426-450).

The expansion which the Army hospital system was destined to undergo is exemplified best by noting that during fiscal year 1945, there were 65 general, 26 regional, and 142 station hospitals operated by the Army Service Forces in the Zone of Interior. Overseas, there were 217 general, 196 station, 91 evacuation, and 99 field hospitals. It was the intense preparation initiated by the Preventive Medicine Subdivision, SGO, and by the Army Medical School and the Army Medical Museum as early as 1939 that made it possible to even approach meeting the demand for laboratory officers and technicians that was to be generated during the years which followed. It might be noted here that more than 300 laboratory officers were required for staffing the service command and department laboratories and the medical field and medical general laboratories alone. During 1945, more than 1,000 Medical Corps laboratory officers and 1,200 Sanitary Corps laboratory officers were on active duty. It is apparent that all of the many efforts to recruit and train laboratory officers and technicians did not produce the number required, but they did produce a medical laboratory organization which could be proud of its achievements, as these were analyzed in retrospect.⁶²

Zone of Interior

In the Zone of Interior, hospitalization was provided by the general, regional, and station hospitals. As mentioned previously, there were 65

⁶² Dammin, G. J.: The Wartime Army Medical Laboratory Activities; Wartime Army Medical Laboratory Organization. *Am. J. Pub. Health* 37: 811-814, July 1947.

general, 26 regional, and 142 station hospitals. Although their work was primarily clinical, the mission of each hospital varied with its location and its designation. Some of the general hospitals served large areas and performed public health laboratory procedures as well as clinical laboratory tests. Other general hospitals were designated for work in particular medical specialties. Laboratory activities, other than those already mentioned, were part of the program of each general hospital laboratory and included training of technicians, service to smaller hospitals, dispensaries, and so forth. The major general hospitals were self-sufficient, with little need to seek consultation or other support from the service command laboratories, the Army Medical School, or the Army Medical Museum.

The mission of the station hospital varied according to the size of the hospital. Some of the larger station hospitals were permitted the same range of laboratory work as were the general hospitals. The regional hospitals had their origins in strategically located station hospitals and were so designated because they were to serve geographic areas. Communication with the service command laboratories was constant, since many of the services needed by these hospital laboratories could be provided only by the command laboratories with their special capabilities in bacteriology, virology, chemistry, parasitology, and veterinary work. The problems faced in attempting to staff the station hospital laboratories adequately with officers and technicians were often unique because of the geographic locations of the hospitals. As one might expect, isolated stations had particular difficulty in obtaining civilian technicians.

It may be said in general for the hospitals in the Zone of Interior that, although it was not always possible to provide the hospital laboratories adequately with staff and with laboratory space, their needs for supplies and equipment were met. The operational level of the individual hospital laboratory was often determined largely by the capabilities of the chief of the laboratory service. Through the commanding officers of the service command laboratories and the medical and surgical consultants of a service command, it was possible for the Laboratories Division, the Army Medical School, and the Army Medical Museum to be kept apprised of the laboratories' needs, particularly with reference to personnel, and these needs were always met as promptly as possible.

Among the larger general hospitals in the Zone of Interior was the Brooke General Hospital at Fort Sam Houston, Tex. Capt. (later Col.) Alfred R. Thomas, Jr., MC, was chief of the Laboratory Service, which had eight branches serving many medical activities on the post. It also served the area as a histopathologic center. Investigative work included a study of the action of penicillin on the gram-negative bacilli and the determination of agglutinin titers in normal serum for dysentery and paradysentery bacteria.

At the Walter Reed General Hospital, the laboratory staff consisted of four Medical Corps officers, one of whom was in charge of the Blood

Donor Section. In charge of the Laboratory Service during 1944 was Lt. Col. Carl J. Lind, Jr., MC. The Chemistry Section, under Capt. (later Maj.) Monroe J. Romansky, MC, was a particularly important section of this laboratory. The evaluation of a depot form of penicillin and also of oral penicillin was carried out by the staff of this section.⁶³ This laboratory later became the center for penicillin research.

A review of annual reports of many of the general hospitals reveals that their laboratories were understaffed in relationship to the volume of work handled. However, reports of studies carried out in the face of such odds give ample evidence of a high degree of dedication and productivity by the entire laboratory staff. Harmon General Hospital, as a tropical disease center, illustrates this point well. With the customary staff for a general hospital, the laboratory performed over 360,000 laboratory procedures in 1 year, and at the same time prepared important reports on particular features of vivax malaria as observed in soldiers returning from the South Pacific area, the effect of chronic relapsing vivax malaria on hepatic function, and the characteristics of filariasis in soldiers returning from the South Pacific. This hospital also performed large-scale surveys for intestinal parasites; hepatic function tests in patients receiving antimony compounds for the treatment of schistosomiasis; antimony levels in plasma, urine, and stool; and evaluated serial stool examinations in the laboratory diagnosis of schistosomiasis japonica.

Evidences of unusual productivity in research also characterized the Moore General Hospital staff in Swannanoa, N.C. Here, the usual level of joint clinical and laboratory participation in studies of malaria, hookworm, schistosomiasis, kala-azar, and filariasis resulted in many important reports.

Overseas Theaters of Operations

Hospitals in the communications zone.—Laboratories which were integral units of hospitals serving overseas are described in War Department Field Manual 8-5, May 1945, "Medical Department Units of a Theater of Operations." The greatest concentration of clinical laboratory activities was found in the hospital centers. The hospital center organization consisted of a headquarters and special staff⁶⁴ which normally administered a center consisting of two or more general hospitals, a convalescent camp, and detachments of other military branches. For economy of operation, certain sections of the general hospitals were assigned to serve the entire center for such activities as laboratory, receiving and evacuation, and medical supplies. The hospital center plan permitted increased specialization in treatment of patients in that certain types of cases would be cared for in one of the general hospitals of the center. The functional pattern of medical laboratories in the hospital center was occasionally modified ac-

⁶³ Romansky, M. J., and Rittman, G. E.: Penicillin: Prolonged Action in Beeswax-Peanut Oil Mixture; Single Injection Treatment of Gonorrhea. Bull. U.S. Army M. Dept. 81: 43-49, October 1944.

⁶⁴ War Department Table of Organization and Equipment No. 8-500, 23 Apr. 1944.

cordingly and therefore took a variety of forms. For example, in some centers, one of the general hospital laboratories might become the bacteriology laboratory, another, the chemistry laboratory, and so forth. In other centers, a single hospital center laboratory was organized with all laboratory activities centralized under the jurisdiction of a single hospital laboratory staff responsible to the hospital center headquarters. In still other centers, each general hospital maintained a laboratory for the simpler procedures used in clinical microscopy, and one laboratory of the center would be prepared for all of the more complex procedures used in chemistry, bacteriology, serology, and the like.

The key role which the hospitals had in the overseas theaters may not be readily apparent. It should be recalled that in some of the theaters of operations, particularly in the Pacific, the hospitals occasionally served large geographic areas. This arrangement was necessary before the arrival of medical general and medical field laboratories in some overseas theaters. Area coverage by the laboratories of larger hospitals was required also when these hospitals, because of their location, could not be served effectively by the independent general and field laboratories. It is clear why preventive medicine officers depended so much on these hospital laboratories and regarded them so highly. The laboratories provided them with data on diagnostic tests required for epidemiological studies and as well with other information ordinarily obtained in civilian life from public health laboratories (water chemistry, toxicology, examination of food handlers, and so forth).

In the communications zone, there were two types of general hospitals, one designed primarily for neuropsychiatric cases⁶⁵ and the other for all other types of clinical problems requiring definitive treatment.⁶⁶ General hospitals in the communications zone were numbered rather than named, as in the Zone of Interior. As mentioned in the opening of this chapter, many of them were identified with medical schools, as for example, the 20th General Hospital with the University of Pennsylvania. Such so-called affiliated hospitals were staffed initially by a medical school and trained as a unit in the Zone of Interior before departing for overseas theaters of operations. The numbered general hospitals were of three sizes: 1,000-bed, 1,500-bed, and 2,000-bed. The laboratory service was one of five professional services, the others being surgical, medical, dental, and X-ray. The laboratory service was headed by a medical officer who supervised the work of three sections: (1) Clinical laboratory, (2) bacteriology and serology, (3) biochemical. Although guides were issued relative to the number of laboratory officers and enlisted technicians to be assigned, particular circumstances occasionally necessitated greater numbers than were authorized. This was particularly true in the general hospitals

⁶⁵ War Department Table of Organization and Equipment No. 8-550S, 26 Oct. 1943, with changes 1 and 2.

⁶⁶ War Department Table of Organization and Equipment No. 8-550, 3 July 1944, with changes 1-5.

serving in tropical areas (fig. 57). The broad scope of laboratory work for which a communications zone general hospital might be responsible was recognized in the preparation of TB MED 135. Those examinations for which the general hospital was not to be responsible were to be performed by a theater's medical general laboratory or a medical field laboratory.

The station hospitals in the communications zone were fixed installations, designed for the hospitalization of post personnel and personnel assigned to adjacent posts, camps, and stations. These were numbered hospitals as were all other hospital units in overseas theaters of operation. Their bed capacities ranged from 25 to 900 beds.⁶⁷ In some geographic areas, it was necessary for the station hospital to extend its services. At times, it might function as a general hospital and at other times as an evacuation hospital. Thus, how a station hospital might be serving would determine the scope of its laboratory services. As one of the professional services, the laboratory service was supervised by a Medical Corps officer charged with providing laboratory support consistent with the current



FIGURE 57.—Laboratory of the 8th General Hospital in Dumbea, New Caledonia. The provision of ample space made for efficient organization and operation. (U.S. Army photograph.)

⁶⁷ War Department Table of Organization and Equipment No. 8-560, 28 Oct. 1944, with changes 1-4.

mission of the hospital. Generally, this consisted of clinical microscopic procedures, blood typing and matching, simpler bacteriological and biochemical examinations, and provision of surgical pathology and autopsy service.

The field hospital was devised in a manner which permitted it to function in one of several possible ways, such as station hospital, evacuation hospital, and so forth. When required, it could operate as three independent hospital units separated one from another by great distances. Although a small unit, the field hospital might be expected to provide definitive treatment because the nature of a geographic area might not permit the establishment of a general hospital. Under such circumstances, the field hospital was housed in permanent buildings or in prefabricated huts. However, the field hospital usually utilized table-of-equipment tentage (fig. 58). Depending upon the field hospital's mission, the laboratory would offer a wide or narrow range of tests and procedures. Service was usually limited to clinical microscopy, with other laboratory tests being performed either by a medical field laboratory, a medical general laboratory, or the laboratory of a larger hospital.

Hospitals in the combat zone.—Evacuation hospitals were organic elements of a field army and were of two types, the 400-bed semimobile and the 750-bed hospital.⁶⁸ The former had sufficient mobility to permit movement of the entire unit when needed, whereas the latter had transportation for administrative use only.

When the 400-bed evacuation hospital operated as a semimobile unit, the range of laboratory procedures was kept at a minimum (fig. 59). However, such hospitals at times served large bases, and under these conditions the range of laboratory work was broader. As in the field hospital, the pharmacy and laboratory were housed in a single tent. Usually the laboratory work was limited to clinical microscopy. Specimens requiring more complicated examinations were referred to a medical field laboratory with which the evacuation hospitals were usually in close and constant contact.

The mission of the 750-bed evacuation hospital differed little from that of the 400-bed hospital. However, because it was larger and less mobile, it served occasionally as a station hospital.

The convalescent hospital⁶⁹ varied in size according to its mission. Its normal capacity was 3,000 patients but, when necessary, it could be expanded to accommodate 5,000 for short periods. Laboratory tests were limited generally to those which could be performed with those items provided in the field laboratory chest.

The portable surgical hospital⁷⁰ was a small mobile unit with a 25-bed

⁶⁸ (1) War Department Table of Organization and Equipment No. 8-581, 26 July 1943 and 25 March 1944. (2) War Department Table of Organization and Equipment No. 8-580, 31 Jan. 1945.

⁶⁹ War Department Table of Organization No. 8-590, 1 Apr. 1942.

⁷⁰ War Department Table of Organization and Equipment No. 8-572, 14 Dec. 1944.



FIGURE 58.—Serology Section, 14th Field Hospital Laboratory, Holtz Bay, Attu. Cpl. John Holliday utilizes U.S. Army and captured Japanese supplies in setting up and operating the section. (U.S. Army photograph.)

capacity. Attached to a division, a task force, or a field army, it was designed to provide emergency surgery and subsequent transport of patients to another hospital in the command for more definitive care. For this reason, laboratory work was limited except in those hospitals whose missions differed from those of the usual portable surgical hospital (fig. 60). During World War II, they were used in the Pacific and in the China-Burma-India Theater, but not in Europe.

The field hospitals, as partly mobile units, could and did serve at times in combat zones.

Investigative work.—During the latter part of 1944 and in early 1945, there were more than 600 hospitals in overseas theaters. This figure included the general, station, evacuation, and field hospitals, as well as other hospitals which, because of their special mission or small size, did not have laboratory services supervised by laboratory officers. Despite an overriding commitment to patient care, the hospital laboratories, often in collaboration with the clinical services, undertook investigative work prompted either



FIGURE 59.—Laboratories of evacuation hospitals. (Top) Laboratory of the 8th Evacuation Hospital at Leghorn, Italy. Water was supplied from the drum. Note construction of laboratory table. (Bottom) Laboratory of the 110th Evacuation Hospital set up in the Benedictine abbey of Saint-Maurice and Saint-Maur, in Clervaux, Luxembourg.



FIGURE 60.—Laboratory of the 1st Portable Surgical Hospital, a unit of the 4th General Hospital, located at Oro Bay, New Guinea, in February 1943. Sgt. Devin E. Posey examines blood film for malaria parasites. (U.S. Army photograph.)

by the nature of the medical problems presented by patients or by the geographic circumstances. Valuable reports emanated from hospital laboratories on the clinical and laboratory aspects of scrub typhus, malaria, intestinal helminths, diphtheria, hepatitis, schistosomiasis, skin infections, fungus infections, bacillary and amebic dysentery, the pneumonias, tuberculosis, the effects of shock and trauma upon the kidney and other vital organs, and of many other militarily important diseases. It would not be possible within the confines of this chapter to acknowledge the many contributions made by the laboratory officers who served in the Army's overseas hospitals. Their work added essential knowledge about diseases which posed new problems for the Army. The addendum to this chapter (pp. 599–603) lists representative papers, published by hospital laboratory officers, which describe observations and investigative work in overseas commands and theaters.

MEDICAL GENERAL LABORATORIES

Laboratory experience during World War I supported the concept that a major overseas theater of operations should have a reference laboratory capable of the definitive type of work performed by the Army Medical School and the Army Medical Museum. Additionally, such a laboratory would be expected to work in the field and to participate in epidemiological studies of infectious disease. In World War I, the performance and contributions of the American Expeditionary Forces base laboratory at Dijon, France, known also as the central Medical Department laboratory, were so outstanding that the decision was made soon thereafter to have such a laboratory in each major theater of operations. The first table of organization for a medical general laboratory, dated 10 January 1922, was identified as T/O 870W. During the next 5 years, revisions were made, and T/O 680W, Medical Laboratory, General, was published on 23 February 1927.

In the spring of 1940, the Preventive Medicine Subdivision reviewed the table of organization for this laboratory, and released a modification, T/O 8-504, on 1 November of that year. The personnel section was modified in the new table, and the qualifications of those to serve in this unit were described in detail. The mission of the new medical laboratory was stated by Major Stone, in a memorandum for the chief of the Planning and Training Division, SGO, dated 3 December 1941. He described the laboratory as a control laboratory to serve hospital and other laboratories of an entire theater of operations outside the continental United States, its size to depend upon the size and location of the theater. The laboratory was intended for general reference laboratory work of which other installations were not capable. Personnel and equipment were to be provided by the laboratory for the study of epidemics and other emergencies, the investigation of which could not be undertaken by other Medical Department laboratories in the theater. Training of laboratory personnel for its own use, and for other units, was to be one of its principal functions, particularly for specialized laboratory work. Briefly, the medical general laboratory was to make a theater of operations self-sufficient in medical laboratory work.

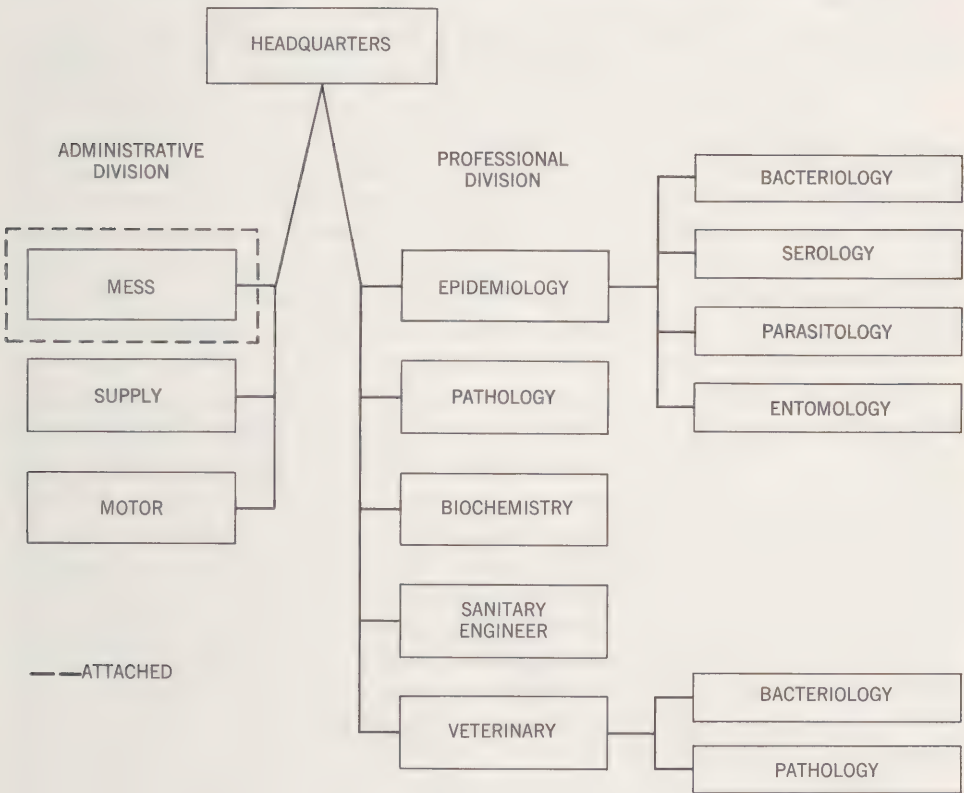
On 1 April 1942, T/O 8-610, Medical General Laboratory, was released and provided for 26 officers and 101 enlisted men with specialists in all of the clinical and public health laboratory disciplines. Capt. (later Col.) Ralph S. Muckenfuss, MC, of the Army's Officers' Reserve Corps, a distinguished scientist and outstanding figure in the field of public health laboratory work, was selected as the commanding officer of the first of these units. In preparation for this important overseas assignment, he was ordered to duty in the Surgeon General's Office to assist in developing laboratory supply and equipment lists. Although only four medical general laboratories were being planned, it was clear that the number of laboratory personnel called for in the April 1942 table of organization could not be

procured, and a new T/O&E 8-610, dated 6 June 1943, reduced the number of officers to 23, and enlisted personnel to 76. The final wartime revision of the medical general laboratory organizational pattern was dated 18 January 1945, and was identified as T/O&E 8-500 HA (chart 13).

European, North African, and Mediterranean Theaters of Operations

The 1st Medical General Laboratory.—A cadre of seven enlisted men under Capt. (later Maj.) Philip R. Carlquist, SnC, was the nucleus of this outstanding laboratory that was to serve longer than any of the other medical general laboratories. It was activated at Camp Rucker, Ala., on 25 June 1942, and in October 1942, it was moved to Fort Sam Houston for training. This was mainly unit training, although some officers and enlisted men were assigned to Brooke General Hospital and the Eighth Service Command Laboratory for laboratory training and experience. Alerted on 5 December 1942, the 1st Medical General Laboratory did not

CHART 13.—*Functional organization of a medical general laboratory*



reach its destination and ultimate site of operation at Salisbury in the United Kingdom until 3 June 1943.

Preparations to receive the 1st Medical General Laboratory in England had been in progress for some time, and these were to give the laboratory a running start in its program of service to the European Theater of Operations. The origin of the 1st Medical General Laboratory can be traced to a faculty committee which President James B. Conant of Harvard University appointed, in August 1939, to determine how that institution could assist in a conflict which had yet to involve the United States on a war basis. The defeat at Dunkirk and other unfortunate events early in 1940 led President Conant to offer to the British War Office any assistance that might be considered useful. In response, a public health unit competent in infectious diseases was requested. The American Red Cross was invited to join in the planning of the unit which ultimately became the American Red Cross-Harvard Field Hospital Unit. It was to be the first American organization to serve overseas in World War II. Construction of hospital and laboratory buildings in Salisbury was begun in 1940 and completed early enough in 1941 to admit patients on 23 September. Construction costs were met by contributions from Harvard University and the American Red Cross.

Therefore, from the first day of war, ETOUSA (European Theater of Operations, U.S. Army) had a preventive medicine service with laboratory support. This feature, which was delayed in all other theaters of war, was a principal factor in the outstanding medical record established in ETOUSA. After the declaration of war in December 1941, the unit was placed at the service of the developing theater. It was mainly an epidemiological unit with field staff, a supporting laboratory, and a 100-bed hospital for observation and study of disease incident to war activities. For a year and a half, the American Red Cross-Harvard Unit provided both laboratory service and field investigation to the theater, first in a voluntary capacity and then for a year as an Army unit.

The unit's status was changed to that of a U.S. Army installation in July 1942. Dr. John E. Gordon, professor of preventive medicine and epidemiology at Harvard University, who had previously directed the unit, was commissioned a lieutenant colonel and assigned to the Office of the Chief Surgeon, ETOUSA, as chief of the Preventive Medicine Division. Col. (later Maj. Gen.) Paul R. Hawley, MC, who had been the medical liaison officer, became the chief surgeon of ETOUSA, and decided to use the American Red Cross-Harvard Unit as a medical general laboratory. Accordingly, he had an order issued activating a provisional medical laboratory to be known as General Medical Laboratory "A." It could not bear a numerical designation, since overseas commanders were not authorized to activate numbered units.

Major Muckenfuss assumed command of the provisional unit on 9

November 1942. In its provisional status, General Medical Laboratory "A" served well as a clinical, laboratory, and epidemiological facility. The tempo of work and the unit productivity were such that the staff of the 1st Medical General Laboratory, arriving from the United States in June 1943, needed only to join a thriving operation and not to develop one.

Laboratory "A" was inactivated and replaced by the 1st Medical General Laboratory in June 1943, with Colonel Muckenfuss assuming command (fig. 61) on 29 June. Colonel Muckenfuss also became the ETOUSA laboratory consultant on 28 May 1943, and served on the theater Communicable Diseases Control Commission.

The hospital unit and the laboratory staff and facilities were merged with the 1st Medical General Laboratory as a continuing activity designed for clinical study and research of area diseases. It administered the joint facility as an Army post. At that point, June 1943, the unit had 39 male officers, 21 nurses, 139 enlisted men, 3 American civilians, and 68 British civilians. The rated capacity of the hospital was initially 100 beds which was reduced later to 50. 1st Lt. (later Capt.) James R. Copeland, SnC, was in charge of the General Bacteriology Division; 1st Lt. Isidore H. Weinstein, SnC, Serology; Capt. Franklin G. Wallace, SnC, Parasitology; Maj. Carroll F. Shukers, MC, Clinical Pathology and Chemistry; Maj. (later Lt. Col.) Edward W. Moore, SnC, Sanitary Engineering; Captain Spring, Laboratory Training; and Maj. (later Lt. Col.) D. Murray Angevine, MC, Pathology Division.

In July 1943, General Hawley ordered that plans be made for supplying blood to forward hospitals in the combat zone. A Whole Blood Service Committee, composed of personnel of General Hawley's Operations Division, recommended that a theater unit be set up to operate the blood service. When General Hawley's request for additional personnel to staff this unit was turned down by the War Department, he obtained the permission of the theater commander to make the 152d Station Hospital, then located at Bath, England, the ETOUSA Blood Bank. This hospital was moved to Salisbury on 22 January 1944, and was placed under Colonel Muckenfuss' command. Maj. (later Lt. Col.) Robert C. Hardin, MC, was transferred to the 152d Station Hospital, where he became executive officer of the blood bank.

To meet the particular personnel needs of the blood bank, most of the general duty medical officers and nurses were transferred out of the unit and were replaced by a staff trained in blood banking techniques. On 17 April 1944, Major Hardin reported that the personnel he had could operate the blood bank through D+60, with further augmentation possibly needed after that date. On 23 May 1944, the blood bank went into full operation and proceeded to support the invasion of the Continent. On 9 July 1944, the 250-bed 127th Station Hospital was also moved to Salisbury and placed under Colonel Muckenfuss' command. Like the 152d, it was transformed



FIGURE 61.—1st Medical General Laboratory, Salisbury, England. (Top) Section in which the laboratory was established. (Bottom) Portion of the hospital section of the laboratory.

into a blood bank. On 26 August 1944, the 152d prepared to move to France, and the 127th assumed full operation of the Salisbury blood bank. Capt. (later Maj.) Forest H. Coulson, MC, directed the technical operations of the bank which operated until May 1945.⁷¹

A Museum and Medical Arts Detachment from the Army Medical Museum, under 1st Lt. (later Capt.) Ralph D. Reed, SnC, was also attached to the 1st Medical General Laboratory.

Soon after the 1st Medical General Laboratory was in full operation, Colonel Muckenfuss visited each of the hospitals and medical field laboratories it served, and arranged for their officers to visit the theater laboratory in return. This plan fostered a good working relationship between the laboratory and the hospital laboratories, and particularly those medical field laboratories which were stationed temporarily near the 1st Medical General Laboratory soon after their arrival in England. Laboratory officers so valued this visit that many of them chose to spend leave time at the laboratory. Of the many services rendered, one of the most important was the provision of standardized solutions and chemical reagents for those laboratories and their detachments which, in moving forward rapidly with the field armies, had little time to prepare reagents. Furthermore, there had been shortages of distilled water, either because of difficulty with stills or because of the nature of local water supplies.

The 1st Medical General Laboratory served the hospitals and field units well from its base in Salisbury until mid-1944. However, it became apparent after D-day that the 1st Medical General Laboratory could not support the European theater adequately from this base. The English Channel was an obstacle to communications and also to the rapid transmission of specimens and reports, thereby impairing seriously the usefulness of the laboratory. The greater distance involved also made it more difficult to provide personal consultations on laboratory problems. Plans were made, therefore, to move the 1st Medical General Laboratory to Paris and to have the 361st Medical Laboratory moved from Paris to the United Kingdom to continue laboratory services for that area which had been served by the 1st Medical General Laboratory (fig. 62).

The move to transfer an advance party of the 1st Medical General Laboratory to Paris was made on 10 March 1945. This detachment was shiploaded and ready for sailing, but the surgeon's office announced a delay, and the British Port Authority disallowed a request for the detachment to stay aboard until departure. The detachment was therefore off-loaded and returned to Salisbury on the same day. The delay proved fortunate, in a sense, because on the following day four detachment officers and 19 other officers and nurses on the post at Salisbury developed bacillary dysentery (Boyd 103), thereby delaying the movement for an entire week. The de-

⁷¹ The detailed story of the ETOUSA Blood Bank at Salisbury and its support of the invasion may be found in Medical Department, United States Army. Blood Program in World War II. Washington: U.S. Government Printing Office, 1964, pp. 496-514.



FIGURE 62.—Laboratory established by an advance detachment, 1st Medical General Laboratory, in Le Mans, France, 1944.

tachment departed Salisbury again and proceeded to Paris, where it established itself in quarters provided by the Pasteur Institute. Following that, the 361st Medical Laboratory left its accommodations at the Pasteur Institute and departed for Salisbury.

Despite the relatively small laboratory area available at the Pasteur Institute, the 1st Medical General Laboratory accomplished considerable work during its stay there. The laboratory quarters at the School of Pharmacy in Paris, which were to have been occupied by the 1st Medical General Laboratory upon arrival in France in March 1945, were not completed until the latter part of May, at which time, components of the laboratory were moved in stages from their welcome but small quarters in the Pasteur Institute to the new location. The entire move was completed on 1 June 1945. Shortly thereafter, members of the 4th Medical Laboratory began to arrive in Paris to take over the work and facilities of Colonel Muckenfuss' laboratory. On 5 June, the 1st Medical General Laboratory was placed on 72-hour alert with instructions to cease operations. Transfer of property was accomplished, thus ending the exciting story of the illustrious 1st Medical General Laboratory, a unit cited often, officially and unofficially, for its meritorious service.

During the latter phases of its operation, research work became an

important activity of the laboratory. For example, an attempt was made to develop a vaccine against scrub typhus. *Leishmania* was identified in lymph nodes and propagated in the chick embryo, and a new variety of *Shigella* was described.

Achievements can be measured also by the volume of material processed and the number of significant accomplishments posted by each division of the laboratory. For example, during the final 5-month period of operation, 1 January–31 May 1945, the Bacteriology Division received 5,689 specimens, on which 7,344 examinations were performed. These consisted largely of serum agglutinations, cultures for identification, studies for tubercle bacilli in various types of specimens, wound cultures for *Clostridia* and specimens for identification of the gonococcus, in addition to almost 1,000 specimens for water bacteriology. The Clinical Pathology Section performed almost 50,000 examinations, which included more than 25,000 blood typings and almost 20,000 urinalyses. Other examinations done in great numbers included hematological and blood chemical tests. The Pathology Division received more than 3,000 specimens which included almost 1,000 autopsies. The Serology Division performed almost 70,000 examinations, the bulk of these being Kahn tests for syphilis. Equally busy were the parasitology, sanitary engineering, toxicology, veterinary, and virus units of the laboratory. The total number of all types of examinations performed during this period of operation was 136,764.

The laboratory was responsible also for distributing biologicals to other Medical Department activities. These included antigens for serological tests for syphilis, standard lyophilized bacterial cultures, specimen tubes, reagents and stains, anti-Rh serum, pH indicator sets, and diagnostic agglutinating serums. Unusual features of the work in bacteriology included an increasing number of toxigenic types of *Corynebacterium diphtheriae*, with the gravis type predominating. *Klebsiella pneumoniae*, type A, was found to be the predominant bacterium in wounds. This organism was identified also in blood and spinal-fluid cultures. Many of the wounds yielded organisms usually considered nonpathogenic; namely, *Proteus*, coliforms, and *Aerobacter*. These were found also in the blood and spinal fluids of patients who had these organisms in their wounds. *Salmonella typhi* was appearing in increased numbers in blood cultures on German prisoners of war. Among special problems investigated was a new type of shigella which was isolated by Capt. George Heller, SnC, and 1st Lt. Shoria G. Wilson, SnC. The same type had been isolated by Dr. Joan Taylor, of the Emergency Public Health Laboratory, at Oxford, and by Capt. William H. Ewing, SnC, of the 15th Medical General Laboratory, in Italy. Captain Heller, with other members of the laboratory staff, developed a rapid method for determining the presence of *Clostridium welchii* in tissue and mixed cultures. Captain Wallace was responsible for developing the method employed at the laboratory for cultivating *Leishmania* in chick embryo yolk-sac cultures.

Colonel Angevine reported that the work volume for the Division of Pathology continued high during early 1945 because of the tendency of hospital laboratories to retain specimens until a hospital's transfer or inactivation. When either occurred, all material in the pathology divisions of these laboratories would be sent in a single shipment to a medical general laboratory. As a result, Colonel Angevine sent to the Army Medical Museum 11 shipments of materials which included 2,194 autopsy cases, 499 surgical specimens, and 393 eyes, in addition to cases from his own Division of Pathology. Important studies conducted in this division were the analyses done by Capt. John Harmon of autopsy cases in which hemoglobinuric nephrosis had occurred, and by Capt. Tom R. Hamilton, MC, of those cases of fatal hepatitis which were attributed to the virus of homologous serum jaundice.

Of 51 cases referred to the Toxicology Division, 16 were found to be fatal cases of methyl alcohol poisoning. Almost half of the specimens submitted for analysis to this division were alcoholic beverages. They were analyzed to determine whether they contained adulterants or poisons. Maj. Monroe E. Freeman, MSC, chief of this division, reported that 4,200 chemical examinations had been performed on about 400 specimens received between 1 January and 31 May 1945.

Maj. (later Lt. Col.) Joseph E. Smadel, MC (fig. 63), chief of the Virus Division, reported on studies of the lymphocytic choriomeningitis virus, *Torula histolytica*, and *Mycobacterium tuberculosis*, which were recovered from patients with meningitis. Psittacosis, "pigeonosis," and pigeon-pox were isolated from sick members of the 280th Pigeon Company, as part of a joint program of surveillance, with the Veterinary Division, for illness in carrier pigeons. The virus of "pigeonosis" was isolated first by this laboratory. Killed vaccines were used in the laboratory as possible protection against experimental scrub typhus infection in mice. In studying the experimental infection, the laboratory noted the presence of soluble antigens of scrub typhus rickettsiae in the blood and in the pleural fluid of mice dying 4 to 6 days after inoculation.

This summary recounts only in part the achievements of this laboratory and the vital role it played in the European theater.

The 15th Medical General Laboratory.—The 15th Medical General Laboratory was the second of the medical general laboratories to be organized during 1942, and the first to be activated at Fort Sam Houston. When activated on 19 December of that year, the unit was quartered in tents, with transfer to a building on the post in prospect. Unit training had to be undertaken promptly since the laboratory was expected to depart for MTOUSA (Mediterranean Theater of Operations, U.S. Army) some 6 months later.

Because of the varied types of laboratory experience represented by those already assigned, several types of training programs were pursued.



FIGURE 63.—Maj. Joseph E. Smadel, MC.

Formal training for officers and enlisted men began on 1 February 1943, and on 13 March the Commanding Officer, Colonel Cornell, joined the laboratory. His efforts to recruit laboratory specialists who might fill the key positions in this important unit were rewarded amply because those who joined the unit included Maj. (later Col.) Tracy B. Mallory, MC, and 1st Lt. (later Capt.) Leslie S. Jolliffe, MC, in the Pathology Section; Capt. Dorsey W. Bruner, VC, and Captain Ewing, in Bacteriology; Capt. (later Maj.) John J. McGraw, Jr., MC, in Serology and Blood Bank; Maj. (later Lt. Col.) Ross L. Gauld, MC, in Epidemiology; and Capt. (later Maj.) Frederick C. Robbins, MC, and 1st Lt. (later Capt.) Robert Rustigian, SnC, in the Virus and Rickettsial Section.

Two courses of unit training were completed by 21 June 1943, but the building for laboratory instruction did not come into use until mid-July. This left only 3 weeks until departure from Fort Sam Houston, so that classes had to be held in several shifts daily during this period. The unit departed for staging at Camp Shanks, N.Y., on 9 August and sailed on 20 August 1943, in the company of two artillery battalions. On the third day of staging, Colonel Cornell was notified that two artillery battalions en route to Camp Shanks had been stricken with bacillary dysentery. Upon their arrival, the attack rate was 70 percent. Under usual circumstances, this outbreak would have delayed departure. However, as soon as it was

agreed that the 15th Medical General Laboratory would care for these battalions, shiploading began. Mass treatment with sulfonamides was started and continued through the first day after boarding ship. In the words of Colonel Cornell, all units on board "had a pleasant and uneventful voyage."⁷² The transport arrived at Oran, Algeria, on 2 September. The unit remained in the staging area near Oran until 19 September, when it moved to share accommodations with the nearby 2d Convalescent Hospital in Bouisseville. Between then and 11 November, when the 15th Medical General Laboratory left for Italy, staff members were fully occupied in supporting medical units in the area and in performing field studies. For example, Major Mallory and Major Gauld went to Sicily to investigate outbreaks of hepatitis and diphtheria. The convoy transport, with the remainder of the unit, reached Naples on 20 November, and the staff proceeded to buildings at the fairgrounds, west of Naples, which already had the beginnings of an army medical center. Delays were encountered and many obstacles had to be surmounted, but the laboratory opened for full operation on 10 January 1944.

As was to be expected from Colonel Cornell, a career Army medical officer whose professional life had been spent in laboratory and epidemiological work, his 15th Medical General Laboratory was well aware of its mission, and it set about to fulfill it in the Mediterranean theater. Letters to various headquarters, hospitals, and other medical installations in the theater announced the beginning of the laboratory's service and the inauguration of a courier system for collecting specimens and delivering reports. The initial number of vehicles allotted to the laboratory made the courier system workable, but a later reduction in vehicle allowances made it necessary for hospitals and other units to use their own vehicles in order to get prompt service.

Colonel Cornell encouraged direct contact and communication between the medical general laboratory and laboratory officers and units in the theaters it served. Through this, many mutual benefits accrued. The service rendered by the 15th Medical General Laboratory was lauded by the many commands whose units it supported. The Blood Bank of the 15th Medical General Laboratory received particular praise from the theater's clinical consultants. Broadly stated, Colonel Cornell believed that, as a theater laboratory, the 15th Medical General Laboratory should support and evaluate all medical laboratories in the command, conduct all necessary public health laboratory procedures not performed at the unit level (for example, toxicology), and conduct research on problems bearing directly upon the health of the military in the command (fig. 64).

Investigative work was conducted on a broad scale in the laboratory and in the field, both independently and with the medical, surgical, and preventive medicine services and units. With assistance from the 15th Medical General Laboratory, Capt. Joseph J. Lulich, MC, was able to under-

⁷² History of the 15th Medical General Laboratory, 20 Dec. 1942–31 May 1944, p. 5.



FIGURE 64.—15th Medical General Laboratory in Naples, Italy. A. T/Sgt. David Massing, Chemistry Section, analyzes Italian-made alcoholic beverages for possible harmful ingredients. B. In the Virus Section, 1st Lt. Robert Rustigian, SnC, examines a recently hatched chick.



FIGURE 64.—Continued. C. A mobile detachment unit of the laboratory serving with the 94th Evacuation Hospital in the Monghidoro area of Italy. Capt. Seymour L. Shapiro, SnC, commanding officer of the unit, is seated at the door. (U.S. Army photographs.)

take his studies of shock on the Anzio beachhead. His “investigations constituted the first scientific study of shock in battle casualties in World War II.”⁷³ Colonel Mallory and Capt. Seymour L. Shapiro, SnC, working with members of the Board for the Study of the Severely Wounded, characterized the renal lesions associated with trauma and shock.⁷⁴ Gas gangrene was investigated by Colonel Mallory, Capt. Louis D. S. Smith, SnC, and 1st Lt. (later Capt.) Robert L. George, SnC, with Maj. (later Col.) Fiorindo A. Simeone, MC, and his surgical associates. Hepatitis, fat embolism, and clostridial myositis were subjects of other reports from the Pathology Section of the 15th Medical General Laboratory. Capt. (later Maj.) John C. Ransmeier, MC, of the 300th General Hospital, was attached to the laboratory for studies on the pharmacology of Atabrine (quinacrine hydrochloride), and Maj. Marshall Hertig, SnC, was also attached to investigate the distribution of sandflies because of the morbidity from sandfly fever.

During the typhus epidemic in Naples, members of the 15th Medical General Laboratory worked with the staffs of the British Typhus Research Team and the U.S.A. Typhus Commission. Cases were studied at the 15th Medical General Laboratory, and specimens for research and teaching were

⁷³ Medical Department, United States Army. *Surgery in World War II. Activities of Surgical Consultants*. Volume I. Washington: U.S. Government Printing Office, 1962, pp. 413–415.

⁷⁴ *Monthly History for September 1944*, 15th Medical General Laboratory, p. 2.

sent to the Army Medical Museum. Maj. (later Lt. Col.) Theodore E. Woodward, MC, of the U.S.A. Typhus Commission, worked at the laboratory during the time he was collecting specimens for serologic studies of epidemic typhus.

In addition to the work on anaerobes and war wounds by the Bacteriology Section, extensive studies of enteric pathogens were undertaken by Capt. William Ewing and Capt. Bruner, since the 15th Medical General Laboratory had become the reference center for agents identified with diarrheal disease. In the Virology Section, Captain Robbins conducted laboratory and field studies of viral influenza and atypical pneumonia.

A major effort which can be regarded as a team enterprise of the 15th Medical General Laboratory was the investigation of Q fever as it occurred in epidemic form among British units in the Mediterranean theater. Details of these important studies, responsibility for which was shared by Colonel Gauld, Captain Robbins, and Lieutenant Rustigian, with others, can be found in the publications listed under reference 71 cited in the addendum (p. 602). Following the identification of Q fever in British troops and distinguishing it from primary atypical pneumonia, outbreaks occurring in U.S. troops stationed in northern Italy in early 1945 were investigated.

The Veterinary Section, under Maj. (later Lt. Col.) Hendrick Versluis, VC, provided strong support for the many diagnostic and research activities through the excellent animal colony which he maintained. This section also conducted chemical analyses of locally procured beverages, a procedure which occupied an inordinate amount of time and taxed the capacities of many of the Medical Department's laboratories. Horses and mules were among the patients of this section. Welcome assistance was given by the 15th Medical General Laboratory to those units of the Fifth U.S. Army, which employed them as pack animals. Both piroplasmosis and epizootic lymphangitis were recognized and studied by this section. In addition, this section operated the theater's salmonella typing center.

Reports of the laboratory's activities, and the high regard in which the unit was held by those served by it, make it apparent that it fulfilled its mission with distinction.⁷⁵ Left unresolved, however, was the matter of channels of authority and communication between the laboratory and the several commands and headquarters with which it dealt. For example, in the 1943 organizational charts for the medical sections of the NATOUSA and MTOUSA headquarters, the medical laboratories were not represented.⁷⁶ By precedent, the channel to this theater surgeon for the theater laboratory was through the theater's preventive medicine office. Col. Perrin H. Long, MC, Chief Consultant in Medicine, NATOUSA, and later of MTOUSA, believed that this pattern was not defensible and that it

⁷⁵ (1) See footnote 72, p. 512. (2) Quarterly Historical Report, 15th Medical General Laboratory, 1 June-30 Sept. 1944.

⁷⁶ Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants. Washington: U.S. Government Printing Office, 1961, pp. 153, 154.

engendered difficulties because clinical laboratory work was regarded as an adjunct to clinical diagnosis and treatment. He was convinced that the supervision of laboratories should be assigned to the Medical Consultants Division rather than the Preventive Medicine Service. This opinion was shared by many clinical consultants. However, the mission of the Army's medical laboratories, as defined earlier in this chapter, calls attention to their responsibility for both public health and clinical laboratory services. In recent years [1964], this has been resolved in part by establishing in the Surgeon General's Office a separate status for the laboratories in a Pathology and Laboratory Sciences Consultants Branch, which is coequal with Medical, Surgical, and other Consultant Branches, under a Consultant's Division.⁷⁷ The writer has promoted and supported this status, not as a compromise position but as a logical one for this independent and not subordinate discipline in medicine.

Pacific Theaters of Operations

The medical general laboratories which were organized to serve the Pacific theaters arrived at their ultimate bases relatively late in the Pacific campaign. The 18th Medical General Laboratory reached Hawaii in August 1944 to serve first the Central Pacific Area and later the Western Pacific Area as well. It supplanted the 14th Medical Laboratory which had been organized in Hawaii to function initially as a department laboratory and later as a Central Pacific Area medical laboratory. The 14th Medical Laboratory was deployed to Okinawa where it served until February 1946. The 19th Medical General Laboratory arrived in Hollandia, New Guinea, in late August 1944 and organized a centralized laboratory service for the Southwest Pacific Area. It could not function as a unit until after its arrival in Manila in July 1945, because buildings for the laboratory were still under construction. Advance echelons moved to the new buildings on 15 September, and all laboratory sections were in operation by early October of 1945.

Some of the delay in requisitioning the medical general laboratories could be traced to differences of opinion in the Pacific theaters about the need for this type of unit, because it was regarded there primarily as a research unit. Some of these deliberations are described by Maj. (later Lt. Col.) Frank Glenn, MC, surgical consultant for the Sixth U.S. Army.⁷⁸ Early plans to request a medical general laboratory were not pursued because of the expressed fear that such a research unit would deprive the wounded of their proper care. Some of the affiliated hospitals had already launched investigations of the major disease problems, and it was considered prudent to requisition a laboratory with certain spaces vacant

⁷⁷ Organizational chart, Office of The Surgeon General, Department of the Army, June 1964.

⁷⁸ Medical Department, United States Army. *Surgery in World War II. Activities of Surgical Consultants.* Volume I. Washington: U.S. Government Printing Office, 1962, pp. 503-504.

so that they could be filled by officers already active in the theaters. The resistance to any research in the jungle was broad enough, however, to delay this decision. Also, some clinical consultants were reluctant to accept a laboratory to which they could relate only through the preventive medicine office of the command. Clinical consultants often expressed their beliefs that there should be a clinical laboratory consultant in the Office of the Chief Medical Consultant.

In retrospect, the earlier presence of a medical general laboratory in the South and Southwest Pacific campaigns would have dispelled many misgivings and would have added considerable and much-needed strength to the hospital laboratories and to the laboratory and field research programs.

The 18th Medical General Laboratory.—The assignment of a cadre of seven enlisted men from Camp Robinson, Ark., to Fort Sam Houston was the beginning of the 18th Medical General Laboratory when it was activated on 10 September 1943. The first officer to join the unit was Colonel Van Auken, who arrived and assumed command on 30 September. 1st Lt. (later Maj.) Benjamin M. Kagan, MC, arrived on 16 October, and when Colonel Van Auken was relieved and transferred to take command of the 9th Medical Laboratory, which was scheduled for the China-Burma-India Theater, Lieutenant Kagan assumed command. On 23 November, Lt. Col. (later Col.) Elbert DeCoursey, MC, arrived and succeeded in command.

By this time, MTP (Mobilization Training Program) 8-1 was under-way. Additional enlisted men with some basic training were given advanced technician training at the Eighth Service Command Laboratory.⁷⁹ When the unit reached its required strength, advanced unit training under MTP 8-10 began.⁸⁰ Much of the training was given at Dodd Field, Tex., a tent city, providing a life not conducive to the strenuous work and study program the 18th Medical General Laboratory was expected to follow. Training aids and equipment were not provided in sufficient quantities, but these were obtained ultimately from Brooke General Hospital and the Eighth Service Command Laboratory. Training was continued at troop and other schools until 1 July 1944, when the unit was transferred to the port of embarkation at Seattle, Wash.

On 17 August 1944, the laboratory arrived in Honolulu, Oahu, Territory of Hawaii. Construction of laboratory buildings was not scheduled for completion until late November. The site selected for the 18th Medical General Laboratory proved to be unfortunate, because of its distance from airfields and hospitals. In the interim, epidemiological and other studies were initiated, some in the forward areas, as mentioned later.

⁷⁹ Medical Department Mobilization Training Program 8-1, Medical Units or Installations and Medical Department Technicians, February 1942.

⁸⁰ Medical Department Mobilization Training Program 8-10, Unit Training of Field Medical Units by the Services of Supply, 29 July 1942.

Serving with Colonel DeCoursey, who was thoroughly versed in the expected mission of this unit on the basis of a long and distinguished career in Army laboratories, were Maj. (later Lt. Col.) Elson B. Helwig, MC; Capt. (later Maj.) Jacob H. Milstone, MC; Maj. (later Lt. Col.) Milward W. Baylis, MC; Lt. Col. (later Col.) Robert H. Yager, VC; Capt. Chester A. Gleiser, VC; Capt. (later Maj.) Robert B. Lindberg, SnC; 1st Lt. (later Capt.) Stanley Marcus, SnC; Maj. Joseph E. Webb, Jr., SnC; Maj. Ralph G. Brown, MC; and Capt. E. Clifford Nelson, SnC. The record of the laboratory sparkles with exciting accounts of missions performed by detachments of officers and enlisted men to Iwo Jima, New Guinea, the Philippines, Okinawa, Saipan, Angaur and Peleliu in the Palau Group, Guam, New Caledonia, and ultimately Japan. Work on such missions brought many letters of commendation and frequent awards to the staff and resulted in the collection of valuable epidemiological data and specimens for laboratory study.

Reports, which became manuscripts submitted for publication, concerned: The influenza epidemics of 1945 and 1946 with influenza B virus identified in the former and type A in the latter; *Salmonella* typing in the Pacific areas; studies of filariasis, schistosomiasis, clonorchiasis, granuloma inguinale, trichomonad and *Haemoproteus* infections, swine erysipelas, brucellosis, piroplasmiasis, and other infections of man and of animals serving man; distribution of DDT by aircraft to control the dengue epidemic in Saipan; the use of DDT for the control of flies, ectoparasites of Signal Corps pigeons, and *Aedes albopictus*, *Aedes aegypti*, and *Stomoxys calcitrans*; bacterial enteric pathogens in more than 7,000 cultures from Japanese, Korean, and Okinawan prisoners of war; an outbreak of amebiasis among troops on Peleliu; use of sulfadiazine in the control of epidemic hemolytic streptococcal infection; and participation in the study on the effects of the atomic bomb in Japan.⁸¹

Technical letters were distributed to the many posts where guidance on laboratory procedures and advice on laboratory matters were needed. These letters were welcomed since they contained outlines of laboratory procedures to be followed in the study of contaminated wounds, bacillary dysentery, and possible viral infections, such as influenza, rabies, and the commoner neurotropic diseases. Through adherence to these guides, valuable specimens were sent to the 18th Medical General Laboratory, and much important epidemiological and laboratory information was obtained.

The laboratory sponsored a continuous training program for officers and enlisted men who were preparing for field work, particularly in the forward areas where new posts were being established. Several hundred students in this program received training in water purification, sanitation, insect control, and laboratory procedures that were applicable to field use.

⁸¹ For pertinent publications, see addendum, pp. 599-603.

The presence of the 5th Museum and Medical Arts Detachment provided good pictorial documentation of work in the laboratory and on its missions to the far-flung islands in the forward areas.⁸²

Of interest, particularly in view of the broad experience which the 1st Medical General Laboratory had gained from sharing a post with a small hospital unit, was Colonel DeCoursey's recommendation that a medical general laboratory should have a special 100-bed unit or other hospital unit adjacent for the close investigation of diseases, particularly those which were peculiar to the area served by the laboratory.⁸³ In the final report of the laboratory, there was criticism, as just mentioned, of the isolated site which had been selected for the 18th Medical General Laboratory, making it necessary for the laboratory to staff such activities as the firehouse, guard detail, sewage disposal, motor pool, and other service functions of a post.

The 19th Medical General Laboratory.—The 19th Medical General Laboratory was the only laboratory of this type to be activated at Fort McPherson, Ga. Activation occurred on 5 October 1943, and Colonel Kuhns assumed command on 3 November 1943. For much of the training period, the officers and enlisted men of the 19th Medical General Laboratory worked with the Fourth Service Command Laboratory on the same post. Colonel Kuhns had been in command of this service command laboratory until joining the 19th Medical General Laboratory so that arrangements for training were made expeditiously. About 60 percent of the time was devoted to technical training and the remainder to unit military training. Many problems were encountered during the training period, some of which could have been avoided had there been more and better trained enlisted men available for assignment to the laboratory. For example, most of those assigned had had only the Army technician school training and had received no instruction in laboratory operation to prepare them for work in a medical field or a medical general laboratory. An entire cadre of seven technicians assigned from Harmon General Hospital was unacceptable because each had a record of one or more summary courts-martial.

The officer staff was of high quality, but many officers arrived late in the training period and could neither assist in the training nor help in the development of the unit and its program. New needs were recognized during the training period, and to meet these, the staff recommended to the Laboratories Division, SGO, an increase in the number of spectrophotometers and electric generators, a manually operated Mimeograph, and a mobile laboratory in a trailer truck.⁸⁴ The first three items, in the numbers recommended, were incorporated ultimately into the list of equipment for a medical general laboratory in T/O&E 8-500 HA, dated 18 January

⁸² (1) Annual Report, 18th Medical General Laboratory, 1945. (2) Unit History, 18th Medical General Laboratory, 1 Sept. 1945 to 1 March 1946.

⁸³ Annual Report, 18th Medical General Laboratory, 1 January-30 June 1946.

⁸⁴ Report, 19th Medical General Laboratory, 5 October-31 December 1943.

1945, but the mobile laboratory was not developed rapidly enough to be of use during World War II. (See pp. 439-441, and 525-528.)

The training program continued into June 1944 while concomitant preparations were being made for shipment to the New Orleans port of embarkation. The major portion of the unit stayed in New Orleans for a month and then departed for Base F in New Guinea where it arrived on 26 August 1944. A small detachment accompanied the unit equipment from San Francisco to its destination at Base B in New Guinea. In September, all units of the laboratory moved to Hollandia, Base G, where the 19th Medical General Laboratory was billeted with the 12th Station Hospital. Hollandia was to be a temporary base since plans called for a forward echelon to move with troops engaged in the advance and a rear echelon to support hospital and other medical units and to conduct epidemiological surveys of scrub typhus, plague, dysentery, and other diseases that were actual or potential hazards to the troops in the Southwest Pacific Area.

On the staff with Colonel Kuhns in Hollandia were: Major French; Lt. Col. Ervin A. Eichhorn, VC; 1st Lt. William Trager, SnC; 2d Lt. (later Capt.) Walter L. Barksdale, SnC; Lt. Col. Willard V. King, SnC; Lt. Col. Lorenzo L. Parks, MC; Capt. (later Maj.) Theodore G. Anderson, SnC; Maj. (later Lt. Col.) Alwin M. Pappenheimer, Jr., SnC; Maj. (later Lt. Col.) Hildrus A. Poindexter, MC; Capt. (later Maj.) Ray E. Trussell, MC; Capt. (later Maj.) John E. Tobie, SnC; 1st Lt. Harry Hoogstraal, SnC; 1st Lt. James P. Toffaleti, SnC; and 1st Lt. Melville C. Hutchinson, SnC.

During November 1944, Colonel Kuhns surveyed the laboratory facilities at the six bases that had been established.⁸⁵ He proposed that each medical laboratory or mobile section of a medical laboratory serve as a central laboratory for each base. This plan would require close liaison between the central laboratory and each of the hospitals supported. Through copies of monthly reports, the medical laboratories were to keep the 19th Medical General Laboratory informed of work volume, laboratory needs, and the like. Unfortunately, the 19th Medical General Laboratory was redesignated and named the 19th Medical Service Detachment (General Laboratory) on 15 November 1944, which resulted in a staff reduction of seven enlisted men.⁸⁶ This reduction was decidedly unwelcome, since it came at a time when the laboratory was doing its utmost to strengthen laboratory services in the theater.

Demand for field studies in forward areas by detachments of the 19th Medical Service Detachment grew rapidly, since the laboratory represented the first large group of laboratory scientists available for the investigation of such problems as hepatitis, poliomyelitis, and schistosomiasis. Results

⁸⁵ Quarterly Report, Commanding Officer, 19th Medical General Laboratory, October-December 1944.

⁸⁶ Special Orders No. 239, Headquarters, U.S. Army, Services of Supply, 12 Nov. 1944.

of such missions were distributed in the command through a laboratory newsletter.⁸⁷ A poliomyelitis epidemic, the peak of which occurred on 29 November 1944, was investigated on Leyte. Of the 36 cases, 12 died with respiratory failure. Autopsies performed on seven of these cases showed lesions characteristic of poliomyelitis. Material from two cases was inoculated into monkeys and resulted in death in 22 days. There had been little or no contact among the cases, but the entire area in which they occurred had poor sanitation. All 36 cases occurred in personnel who had only recently arrived in Leyte. An intestinal parasite survey of 282 civilians on Leyte, conducted soon after the invasion, showed more than 75 percent were positive for ascaris, Trichuris, and hookworm eggs, and 22 percent were positive for schistosome eggs. *E. histolytica* was found in 1 percent only. Other items in the laboratory newsletter concerned laboratory techniques.

Histopathologic services could not be established until March 1945 because of a lack of housing, supplies, and equipment at Base G. In March 1945, the 19th Medical Service Detachment was designated as the histopathologic center for the Southwest Pacific Area. This had been a particular concern of the laboratory, since without transfer of tissues and protocols to the 19th Medical Service Detachment, no substantial data could be collected on the causes of death or on the quality of the laboratory work in the theater, and there could be no centralized mechanism for referring cases to the Army Medical Museum.⁸⁸ With its designation as a histopathologic center, the 19th Medical Service Detachment could function in the role it had sought, reports on specimens submitted to it could be expedited to hospitals and laboratories it served, and cases could be shipped to the museum. Prominent among the cases studied were instances of hepatitis, scrub typhus, diphtheria, poliomyelitis, and schistosomiasis. Unfortunately, at a time when the photographic recording of cases and specimens was needed most, the photographic laboratory had to cease functioning because of lack of supplies.

In April 1945, the unit became known again as the 19th Medical General Laboratory. The work at Base G had expanded as had studies in the field, especially in the Philippines. For example, in August, at the request of the Pacific Welfare Board, carbon monoxide content in blood samples was measured in soldiers who were in vehicles on the tank deck of an LST (landing ship, tank) during landing operations. It was determined that, beginning about midship and moving toward the stern, carbon monoxide content in the soldier's blood increased progressively, so that soldiers in the rear vehicles had carbon monoxide levels which approached

⁸⁷ Letter, Headquarters, 19th Medical Service Detachment (General Laboratory), U.S. Army, Services of Supply, 27 Jan. 1945, subject: Letter of Information for Laboratory Personnel.

⁸⁸ Letter, Headquarters, United States Army in the Far East, to Commanding Generals, Sixth U.S. Army; Eighth U.S. Army; Replacement Command, United States Army in the Far East; Far East Forces; U.S. Army, Services of Supply; United States Air Force, North Solomons; 14th Antiaircraft Command; and Army Transport Command, 6 Mar. 1945, subject: Medical Laboratory Service.

a critical point. It was evident from this finding that better control of ventilation in the stern portion of the LST was necessary.⁸⁹

There was concentration on the investigation of diarrheal diseases, the bacteriology of war wounds, fevers of undetermined origin, schistosomiasis, filariasis, and insect vectors of the many diseases of military importance in the region.⁹⁰ Advance units in the Philippines were fully and variously occupied. Captain Trussell, with a staff of 40, was directing a venereal disease treatment center. Syphilis, chancroid, and gonococcal infection rates were unusually high. Lieutenant Barksdale, with Sixth U.S. Army headquarters, described his concern about the problems raised by amebiasis, malaria, hepatitis, and fungus infections. The devastation in the Manila area, described by 1st Lt. William H. Lee, MSC, made it clear that all accommodations required by the 19th Medical General Laboratory would have to be constructed if Manila was to be the site of the finally unified laboratory.⁹¹

The transfer from Hollandia to Manila began on 28 June 1945, and arrivals in the Philippines began on 8 July. Pending completion of laboratory facilities, the 19th Medical General Laboratory utilized space in the 26th Hospital Center (fig. 65). Maj. Arthur Stull, SnC, was assigned to the 19th Medical General Laboratory by the Laboratories Division, Preventive Medicine Service, SGO. He joined the laboratory as chief of the Chemistry Section. While quarters of the new laboratory were being occupied after cessation of hostilities, the volume of work increased due to the inactivation of hospital and laboratory units and the rotation of laboratory personnel to the United States on the basis of their adjusted rating service scores. In addition to the continuing problems resulting from high venereal disease rates, the laboratory had to plan for still another large responsibility because it was to be designated as the theater blood bank. Plans for establishing this facility had to be hurried since shipment of blood from continental United States was to be discontinued on 15 September 1945. This was done, and the blood bank was in full operation on 1 October.

Colonel Kuhns was designated Theater Laboratory Consultant, U.S. Army Forces, Western Pacific, in September 1945, and began a survey of laboratories in order to plan for area laboratory services during the immediate postwar period. Paradoxically, for the large hospital laboratories, the medical field laboratories, and the 19th Medical General Laboratory, the end of hostilities did not begin a period of retrenchment or a curtailing of services. The volume of work increased markedly in some sections of the laboratory, especially in pathology and serology. Time required for the accession, processing, study, and transshipment of surgical and autopsy cases referred by installations which were moving or closing, increased enormously. The continued high rates for venereal disease, in

⁸⁹ Monthly Report, 19th Medical General Laboratory, August 1945.

⁹⁰ For pertinent publications, see addendum, pp. 599-603.

⁹¹ Monthly Report, 19th Medical General Laboratory, April 1945.



FIGURE 65.—Aerial view of the 19th Medical General Laboratory soon after its establishment near Manila, Philippine Islands, in October 1945.

some units more than 200 per 1,000 per annum, created an enormous volume of serologic work, particularly for the 19th Medical General Laboratory, which now accepted specimens that could no longer be processed by those laboratories which were being inactivated or transferred.⁹²

Studies of American and Allied prisoners of war required support from the 19th Medical General Laboratory, and included surveys on nutrition and for malarial and intestinal parasites. The nutritional and general health problems of those prisoners freed from the Bilibid prison were the subject of a special study undertaken at the direction of General Morgan. It was concluded that, among the British nationals who were former prisoners of war, most of the diarrheal disease was unrelated to specific bacterial or protozoal infection. Only 0.6 percent had amebic infection and 3 percent had *Shigella* infection. However, the percentage of patients with diarrheal disease was high; namely, 51 percent. These observations were made on patients of the 248th General Hospital.⁹³

Working with various sections of the 19th Medical General Laboratory were members of commissions of the Army Epidemiological Board. These

⁹² Monthly Report, 19th Medical General Laboratory, September 1945.

⁹³ Quarterly Historical Report, 19th Medical General Laboratory, October–December 1945.

included Lt. Col. Albert B. Sabin, MC, of the Neurotropic Virus Commission, who was investigating Japanese B encephalitis and undertaking development of a vaccine. From the virological section of the laboratory, stool specimens were being shipped to Dr. John R. Paul, of the Neurotropic Virus Commission, for isolation of poliomyelitis viruses. In another section of the laboratory, the Samar strain of scrub typhus, which had been obtained from Major Woodward of the U.S.A. Typhus Commission, was being studied to determine its lethality for mice.⁹⁴

Another postwar study in which the staff of the 19th Medical General Laboratory was required to participate was a survey of laboratory facilities in Japan to prepare for the transfer of medical units into that country. Such studies had to be conducted by senior officers, thus depriving the laboratory of their services. On 12 September 1945, the chiefs of the Chemistry, Bacteriology, and Parasitology Sections (Major Stull, Major Anderson, and Captain Tobie) were placed on detached service with General Headquarters and departed for Japan.⁹⁵

The demand for laboratory technicians continued high, and as late as October 1945, it was necessary to establish courses for technicians at the 19th Medical General Laboratory.⁹⁶ Laboratory needs peculiar to this period were emphasized, and training was concentrated on serology and parasitology. The loss of enlisted technicians, through rotation to continental United States, continued into November 1945, making the operation of these courses mandatory.

The closing of the 363d Medical Laboratory, which had served the Manila area well during the months before the arrival of the 19th Medical General Laboratory, imposed particular demands on the latter, which was already receiving more than 500 specimens per day. Some of this volume from local hospitals could be attributed to the high venereal disease rate (104 per 1,000) and diarrheal disease rate (335 per 1,000) reported from troops of the General Engineering District.⁹⁷

It should be apparent from the references made to the capabilities and high level of performance of the 19th Medical General Laboratory that its services were needed earlier in this area of the Pacific theater of operations. Furthermore, the enthusiasm to return laboratory personnel to the Zone of Interior at the end of hostilities in the Pacific should have been tempered by an understanding of what laboratory services would be required at that time. The military group had an understanding of these requirements, but it was not possible to have it shared and accepted by members of the Congress and of the press.

⁹⁴ See footnote 89, p. 522.

⁹⁵ See footnote 92, p. 523.

⁹⁶ Monthly Report, 19th Medical General Laboratory, October 1945.

⁹⁷ Monthly Report, 19th Medical General Laboratory, November 1945.

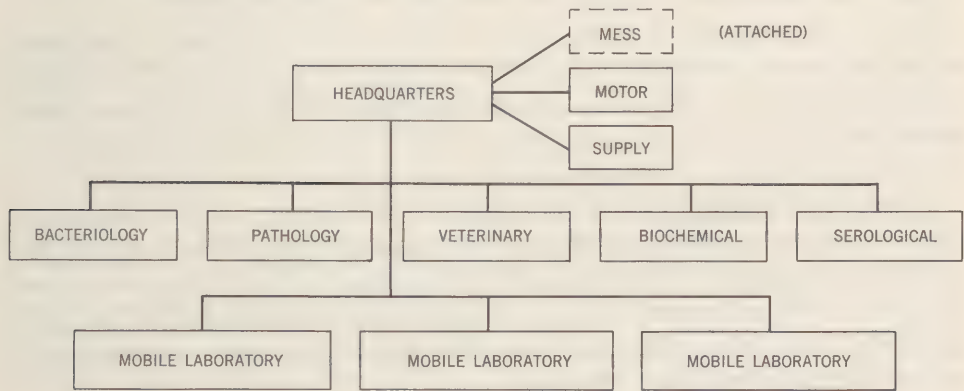
MEDICAL FIELD LABORATORIES

Preparation and Development

Medical field laboratories had been found so useful in World War I that there was great interest in pursuing their development in the early postwar period. Proposals containing a table of organization for such a laboratory were prepared in 1921 and were revised in 1922 and in 1927. Throughout the planning, the mobility of these laboratories was the feature which commanded the most attention. Early in 1940, with the establishment of the Preventive Medicine Subdivision, there was increased interest in the development of medical field laboratories for epidemiological and sanitary investigations. It was recognized that such units should be capable of a wide range of diagnostic work, and this was provided for in T/O 8-234, dated 1 October 1940, for the redesigned Medical Laboratory, Army or Communications Zone. The subsequent revision, T/O 8-611, dated 1 April 1942, set the pattern which was to be followed for most of World War II. The identification, T/O&E 8-500 HB, adopted in May 1945, is the one which was described in War Department Field Manual 8-5, "Medical Department Units of a Theater of Operations" (chart 14).

The medical field laboratory's base section had seven laboratory officers, and one Medical Administrative Corps officer who served as executive officer. For each of the three sections, there was a medical laboratory officer in the grade of captain. The enlisted corps consisted of 51 men; about half of them were laboratory technicians. Although the mobile sections were used in field operations, laboratory trucks were not part of the unit's equipment. As mentioned previously, trucks were modified to act as mobile laboratories, but no laboratory trucks were shipped overseas. As units to be assigned overseas, the medical field laboratories

CHART 14.—*Functional organization of a medical field laboratory*



were activated and trained under the Army Ground Forces in the Zone of Interior. Assignment to, and training under, Army Ground Forces assured the assignment and retention of key laboratory personnel. Ten medical laboratories were activated initially; five trained at Fort Sam Houston and five at Camp Rucker. The 2d Medical Laboratory, activated at Fort Sam Houston on 1 September 1940, was the first to enter a training status. The total number reached 19, as eight additional medical laboratories were activated during 1944 and one in 1945.

Although the concept of the medical field laboratory was not new, its mission had to be understood and accepted if the laboratory was to be used with optimum effectiveness. During 1942, the period of greatest expansion in the number of these units, their function was again defined. Broadly stated, the unit was to serve as an epidemiological and sanitary laboratory capable of performing studies required in the control and the prevention of disease. It was also to supplement the laboratory facilities of hospitals and other medical units such as aid stations and dispensaries. It was to be under the control of an army or a communications zone surgeon. Recommendations were made regarding transportation, with the stipulation that the smallest vehicles available, because of their lower silhouette, would be used for the transport of personnel, laboratory supplies, and specimens. The mobile sections were designed to collect specimens for definitive work to be done at the base section laboratory.

The mission of these laboratories was intended to be primarily epidemiological, but many of them found themselves conducting large volumes of diagnostic work for smaller hospitals. Some of the laboratories established blood banks to serve an area, a function for which the medical field laboratory was often better equipped than was a hospital. In the account which follows, it will be noted that these laboratories served creditably, and many achieved distinction. However, perhaps because of terrain, shorter distances between installations, and feasibility of communication, these laboratories functioned better in the North African, Mediterranean, and European campaigns than they did in the Pacific.

It is appropriate to group these laboratories according to the three major geographic areas in which they served, as identified by campaigns and commands: (1) European, Mediterranean, and North African (eight laboratories); (2) Pacific (nine laboratories); and (3) China-Burma-India (two laboratories).

The eight medical laboratories numbered the 1st, 2d, 4th, 7th, 10th, 28th, 361st, and 362d served in the European, Mediterranean, and North African campaigns. (The 28th served also in the Pacific.) The nine medical laboratories which operated in the Pacific theaters were the 3d, 5th, 6th, 8th, 12th, 14th, 26th, 27th, and 363d. The 9th and the 29th were assigned to the China-Burma-India Theater.

The medical laboratories serving in the European, Mediterranean, North African, and Pacific theaters functioned with the armies to which they had been assigned from the beginning of each major campaign. This did not occur in the China-Burma-India Theater which was served initially by the 9th, and later by the 29th, Medical Laboratory. The 9th Medical Laboratory arrived in the summer of 1944, shortly after this theater was divided into the India-Burma and the China Theaters, and supported operations in both theaters. The 29th Medical Laboratory did not reach India until May 1945. It is unfortunate that the 9th and the 29th Medical Laboratories did not reach these theaters until the late dates mentioned. They could have functioned and served even better had they arrived earlier, when the hospitals and other medical units in the field required considerably more assistance.

Although the medical field laboratories accumulated an enviable service record during World War II, it is apparent that their operation was not optimum because they lacked the required mobility and their equipment lists did not reflect their needs adequately, as described in this and other parts of this chapter. During the immediate postwar period, little was done to evaluate the equipment and supply requirements of this field unit, but much effort was expended in determining the triservice utility of items in the laboratory sections of the medical supply catalog.⁹⁸

⁹⁸ Plans were made in 1960 to undertake a thorough reevaluation of the role and capabilities of the Medical Laboratory, T/O&E 8-650D, dated 21 June 1957. Helpful to the development of these plans was the analysis of the combat readiness of the medical laboratory, which was carried out by Lt. Col. F. K. Mostofi, MC. Colonel Mostofi's report, dated 1 September 1960, was prepared during a 2 weeks' tour of active duty in the Research and Development Command and recommended that attention be given to two basic inadequacies; namely, laboratory equipment and training. He urged that the Command offer direct support to the development of the medical laboratory in order that it might be prepared for a field trial. Medical Laboratory, T/O&E 8-650D, had not been field tested, and the Army had not had a medical laboratory in the field since the Korean War.

In 1961, a Medical Laboratory Test Unit was established at the Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Tex., under Lt. Col. John M. Lukeman, MC. The Laboratory to be tested had been approved in 1957 and was designed to supersede both the Medical Field Laboratory, Army, 12 January 1956 (T/O&E 8-640C), and the Medical General Laboratory, Communications Zone (T/O&E 8-650C). The test, termed "Operation Shakedown," was conducted at Fort Sam Houston in the fall of 1962. Colonel Lukeman's report entitled, "Operation Shakedown: After Action Report of the Troop Test with a Mobile Section of the Medical Laboratory 8-650D, 28 September 1962 through 27 October 1962," makes it apparent that the test revealed many of the equipment items to be designed primarily for use in fixed installations. They were heavy, required not only great care during their transport, but also careful calibration after each move. Most of the equipment was unsuited for rapid mobility, and many items required nonstandard accessories to make them operational or to broaden their usability. Operational delays occurred because reagents and media had to be prepared from constituents in bulk form. No media or reagents were furnished in a preweighed and prepackaged form. During the test, a list of 488 procedures was prepared, representing laboratory tests considered essential to the laboratory's operation. Of this total, only 37 percent could be carried out with the then standard and authorized equipment and supplies. Since this laboratory, T/O&E 8-650D, was the Army's only field medical laboratory, and since this unit did not meet the requirements expected of it, a new material development objective was formulated in 1964.

Recent developments have concentrated on providing the Army with an entirely new "field medical laboratory," the designation adopted for this proposed unit. The requirement for a new type of field medical laboratory was defined by the U.S. Army Combat Developments Command headquarters at Fort Belvoir, in a letter, dated 29 June 1964, subject: Department of the Army Approved Qualitative Material Development Objective for a Field Medical Laboratory. In this letter, the need for a highly mobile unit which could serve field armies or separate commands was underlined. The mission for the new field medical laboratory was outlined in the technical development plan as follows: "The mission of a field medical laboratory is to provide laboratory service to field armies and separate commands, to survey infectious disease agents, to evaluate

The laboratory truck, which was to be an integral component of each of the three mobile sections of the laboratory, was not produced in time for use during World War II. After the war, laboratory trucks were sent to laboratories serving overseas armies and to the army area commands of the continental United States. They were used also in the Korean War.⁹⁹

European, North African, and Mediterranean Theaters of Operations

The 1st Medical Laboratory.—The 1st Medical Laboratory was activated at Fort Sam Houston on 20 March 1942. The first few months were occupied fully with unit training, the training of laboratory technicians, in a school established for field units at Fort Sam Houston, and the training of officers through participation in courses given at the Army Medical School. The Commanding Officer, Lt. Col. Hugh A. McKinley, MC, was enthusiastic about the laboratory technician course sponsored and operated by officers of the 1st, 2d, 4th, and 5th Medical Laboratories for the enlisted technicians and other personnel assigned to units in training at Fort Sam Houston. From July through November, the unit participated in the Camp Polk, La., maneuvers, during which time several outbreaks of bacillary dysentery were investigated by the laboratory. Following the extended experience in the Camp Polk maneuver area, the laboratory returned to Fort Sam Houston, where it remained until 1 December 1942, when it was transferred to Dodd Field. The succeeding months were again occupied with unit training, and officers were sent on detached service for courses at the Army Medical School. On 10 February 1943, orders were received for movement to the New York Port of Embarkation. After many delays and trials, this now well-seasoned unit departed from New York on 5 March, and arrived in Oran on 19 March 1943.

Mobile units and small detachments of the laboratory were soon detailed to various duties pending the establishment of its own facilities. The equipment required by Mobile Unit I of the 1st Medical Laboratory is shown in figure 66. During this period, the laboratory was fully occupied

the actual or potential hazard to personnel, animals or food, and to support clinical analysis of biological agents." The manner in which this mission was to be accomplished represented a revolutionary development. The laboratory was to be capable of being moved rapidly by air or surface, become operational within 3 hours after arrival at a site, and be dust- and contamination-free. The type of bacteriological and other work expected of this laboratory established the requirement for air conditioning. The development of a field medical laboratory with these characteristics became the responsibility of the Commanding General, U.S. Army Medical Research and Development Command. An important step in creating such a laboratory was the development of the MUST (Medical Unit, Self-Contained, Transportable). Units of the MUST system are to be usable singly or in multiples to form a field hospital complex. Such units were demonstrated at the Brooke Army Medical Center at Fort Sam Houston in February 1965. The basic medical unit contains three compact transportable elements: surgical, ward, and utility. Thus, the structure to house a field medical laboratory and the utilities needed to power and air condition the laboratory became available with the development of the MUST units.

⁹⁹ The medical laboratory truck was reevaluated by the Armed Services Medical Material Coordinating Committee in 1956. The Committee monitored a program which included the construction of a new prototype truck and its field testing at Fort Knox, Ky. The program was canceled in 1957 when the U.S. Continental Army Command ruled that the development of special-purpose vehicles was to be terminated and that only general-purpose vehicles were to be developed further.



FIGURE 66.—Display of equipment required by a mobile unit of the 1st Medical Laboratory.

with studies of enteric infections, and it collected valuable material from the autopsies performed. The laboratory investigated bacillary dysentery in the 34th Division during May 1943, typhoid fever in the 335th Engineer Battalion during September 1943, and food poisoning outbreaks in several companies of the 357th Engineer Battalion in November 1943. Publications from the laboratory during this period pertained to acute enteritis, the function of the mobile medical laboratory in North Africa, mess sanitation under field conditions, and a description of a new *Shigella*. Colonel McKinley particularly noted the interest in, and the attendance by members of all medical units in Eastern Base Section at, the clinicopathological conferences conducted by the laboratory.¹⁰⁰

While detachments served on various projects, the base laboratory was transferred to Naples, Italy, in April 1944. Upon arrival there, a blood transfusion unit was organized which functioned as part of the base laboratory. In July, the laboratory was transferred to the Seventh U.S. Army. Following transshipment to Marseilles, France, in the first convoy to enter that port, the laboratory served with the Seventh U.S. Army, although mobile units were still serving in Sardinia with the Allied gar-

¹⁰⁰ History of the 1st Medical Laboratory, 20 Mar. 1942–31 Dec. 1943.

risson. In addition to the support given to many of the hospital laboratories, special assistance was provided for the investigations of viral hepatitis, diarrheal disease, and venereal disease. Considerable work was concentrated on throat cultures for diphtheria, wound cultures for anaerobes, specimens from cases of food poisoning and dysentery, parasitological examinations on civilian employees, and examinations in the categories of clinical hematology, chemistry, toxicology, and pathology. Assistance received while in Italy, from the 15th Medical General Laboratory, and later, in France, from the 1st Medical General Laboratory, is recorded in Colonel McKinley's report covering these phases of the laboratory's operation.¹⁰¹

The 2d Medical Laboratory.—The 2d Medical Laboratory, activated on 1 September 1940, at Fort Sam Houston, was initially under the command of Maj. (later Lt. Col.) Hugh MacDonald, MC. In command later during the training period was Capt. (later Col.) Charles J. Farinacci, MC. Detachments of the laboratory were sent to a variety of exercises and maneuvers in Texas and Louisiana for field experience (fig. 67). Colonel Ernst assumed command before embarkation and remained in command throughout the North African and Mediterranean campaigns. The laboratory arrived in Casablanca on 24 December 1942, without any of its organizational equipment. Space was appropriated in a local factory, and by using borrowed equipment, the laboratory performed water analyses, Kahn tests, bacteriological examinations, and histological studies. When the laboratory's own equipment arrived, three mobile sections were sent to field medical units which had no laboratories or which had been receiving no laboratory support. Bacillary dysentery proved to be a major burden for the laboratory, but many of the cases could not be studied bacteriologically because supplies were not adequate. Surveys were made of the local water and food supplies, and many food handlers were examined. Laboratory personnel not active with mobile units were assigned to hospital laboratories.¹⁰²

The 2d Medical Laboratory left North Africa as a unit and arrived in Italy in October 1943. After considerable difficulty arising from a lack of transportation, the laboratory ultimately had its three mobile sections again active by the end of October. One supported the local hospitals and dispensaries, another served with the 15th Evacuation Hospital near Piedmont, and the third was assigned to a venereal diseases hospital. During this period of operation, Colonel Ernst was able to further the development of the laboratory truck. In North Africa, he had found that, with little alteration, an ordnance small arms truck was suitable for such work. He sought authorization to requisition additional trucks of this type for use as laboratory trucks, but his request was disapproved. Capt. Jack H. Hill, MC, then designed a laboratory that could be placed on the body of a 2½-ton truck.

¹⁰¹ Annual Report, 1st Medical Laboratory, 1944.

¹⁰² Organizational History, 2d Medical Laboratory, 1942-43.



FIGURE 67.—The 2d Medical Laboratory at Third U.S. Army maneuvers, Lake Charles, La., in September 1941. (Top) Mobile unit which served with the 43d Evacuation Hospital. (Bottom) Interior of trailer of mobile unit. (U.S. Army photographs.)



FIGURE 68.—Courier jeep at Headquarters, 2d Medical Laboratory, in Italy with the Fifth U.S. Army.

One of the major activities of the unit became the study of war wounds for anaerobes related to gas gangrene. For this work, it was necessary to improvise anaerobic jars, and these were made from shell casings obtained from the Ordnance Department. Throughout this period, in 1944, the 2d Medical Laboratory served with the Fifth U.S. Army (fig. 68).¹⁰³

The 4th Medical Laboratory.—The 4th Medical Laboratory had what it considered to be a valuable period of training at Fort Sam Houston before shipment overseas. After almost a year of training, the unit was shipped to North Africa where it arrived in April 1943, and operated in detachments until it could set up for operation as a unit on 2 June 1943.¹⁰⁴ It was learned too late that the laboratory was expected to perform tissue pathology, so that supplies and equipment for this service had to be obtained overseas. Since no freezing microtome was available through local depots, it was necessary to design and construct one. This was accomplished by an ordnance unit. The earlier work of the laboratory was dominated by studies of bacillary dysentery, with as many as 500 specimens reaching the laboratory daily. In the course of this work, it was found that half the men working in the bacteriology laboratory also had stools positive for *Shigellas*. In the summer of 1943, malaria became a serious burden

¹⁰³ Annual Report, 2d Medical Laboratory, 1 January–31 December 1944.

¹⁰⁴ History of the 4th Medical Laboratory, 1943.

for the laboratory, and in the fall, typhoid fever was studied by the Bacteriology and Pathology Sections. Food bacteriology became an important activity of the Veterinary Section. The Chemistry Section was called upon frequently for toxicological study of large quantities of native wines. The Serology Section, although active, was often hampered by an unsuitable water supply.

Under the new T/O&E 8-611, dated 25 August 1943, and received in December 1943, four spaces for enlisted men had been deleted. The Commanding Officer, Lt. Col. Richard P. Mason, MC, reported that while the unit could adjust to this reduction in personnel, the new list also eliminated two typewriters, and this deficiency could not be corrected readily. The need for a laboratory vehicle was apparent and, as reported by other medical laboratories in this theater, an ordnance small arms repair truck was found to serve such a purpose.

Colonel Mason, relieved of assignment to the 4th Medical Laboratory in March 1944, was assigned to the Medical Section, Services of Supply, NATOUSA. Maj. (later Lt. Col.) William H. Riser, Jr., MC, then assumed command. In May 1944, a mobile section departed for Corsica where it was to engage primarily in malarial work, assist in training other laboratory personnel, and investigate bacillary dysentery.

The 4th Medical Laboratory completed its tour of duty in North Africa in August 1944, and left from Oran, for Sainte-Maxime, France, where it arrived on 9 September 1944. After debarking, it proceeded to Dijon, where it set up operations. Soon thereafter, the laboratory was ordered to send its base section to Marseille, leaving a mobile section in Dijon. In Dijon, this section was quartered in the same university building used by the central laboratory of World War I. The director of the Hygiene Laboratory in Dijon, who had held this position since World War I, welcomed the unit enthusiastically. In the building, there was still an American incubator and a set of test tubes which had been used by the central laboratory; on the wall was a duty roster listing those Americans who had served in the laboratory more than 25 years before (pp. 422-423).¹⁰⁵

Most of the work of the base section in Marseille was in support of hospitals and dispensaries and was large in volume. Detachments were sent out on special assignments, such as bacteriological studies of war wounds.

In May 1945, the base section was ordered from Marseille to Paris with instructions to replace the 1st Medical General Laboratory and assume its function. On 7 June 1945, all duties of the 1st Medical General Laboratory were transferred to the 4th Medical Laboratory. During that month, the Commanding Officer, Colonel Riser, was ordered to return to the United States for reassignment, and Maj. (later Lt. Col.) Everett W. Reinardy, MC, assumed command. Reports relate the great difficulty which this laboratory had in meeting the responsibilities which the 1st Medical

¹⁰⁵ See footnote 100, p. 529.

General Laboratory had carried. Particular reference is made to the Pathology Section's accessions which increased by more than 500 percent. The 4th Medical Laboratory was expected to process or transship to the Army Medical Museum, pathology accessions referred by the many hospitals and laboratories either being inactivated or being transferred to a new command. Since inactivations and transfers were occurring at a rapid rate, an increasing volume of work was referred to the 4th Medical Laboratory in its capacity as the theater laboratory.¹⁰⁶

A particular point was made by Colonel Reinardy about the grades of the laboratory officers in charge of sections of a theater or other reference laboratory. Often these officers dealt with laboratory officers in general hospitals who invariably were senior to themselves. Since the 4th Medical Laboratory was serving as the theater laboratory, Colonel Reinardy recommended that chiefs of sections, particularly pathology, have a grade no lower than lieutenant colonel.¹⁰⁷

The 7th Medical Laboratory.—The 7th Medical Laboratory was activated at Camp Rucker, Ala., on 15 July 1942, and was assigned to the Second U.S. Army. The first medical officer to assume command was Maj. (later Lt. Col.) Peter Manjos, MC. During the training period, the 7th Medical Laboratory participated in field maneuvers which provided ample opportunity for study of dysentery epidemics. The training period was completed in the California-Arizona maneuver area, and, in April 1944, the unit departed for assignment to the European theater and duty with the Third U.S. Army. The laboratory staged in the United Kingdom and departed on 14 July 1944 for Utah Beach on the Continent. Forward movement of the Third U.S. Army was so rapid that there was little time to establish a base section or mobile sections for any length of time. A major earlier activity of one of the mobile sections was the establishment of a venereal disease unit in conjunction with the 6th Convalescent Hospital to which all cases of primary syphilis were being transferred. The advance of the Third U.S. Army made it desirable for the laboratory to have a headquarters and two separate technical sections, each competent to perform the commonly requested laboratory procedures. By this arrangement, one of the sections was always in operation, while the other might be moving forward with major elements of the Third U.S. Army. This pattern of field operation resulted in an unusual distribution of the types of laboratory work carried out by the laboratory. For example, more than 60 percent of the work was in serology and about 15 percent each were in bacteriology and venereal disease diagnosed by darkfield examination. There was little pathology, chemistry, parasitology, or even hematology done during this time.¹⁰⁸

¹⁰⁶ Semiannual Report, 4th Medical Laboratory, 1 January–30 June 1945.

¹⁰⁷ Letter, Lt. Col. Everett W. Reinardy, MC, 4th Medical Laboratory, to Maj. Oliver J. Irish, SnC, Historical Division, Office of The Surgeon General, U.S. Army, 7 Feb. 1946.

¹⁰⁸ Annual Report, 7th Medical Laboratory, 1944.

In January 1945, the 7th Medical Laboratory was operating in two sections, one in Luxembourg and the other in Metz, with Maj. Colin F. Vorder Bruegge, MC, in command. The forward movement of the Third U.S. Army continued, and it was not until late April that the laboratory was in a position to undertake a wider variety of work. As field activities subsided, the variety and volume of work increased enormously. The increase was related not only to a rise in the venereal disease rate, but also to the treatment of new categories of patients entering hospitals served by the 7th Medical Laboratory. In June 1945, the base section moved to Gräfelfing, near Munich (fig. 69). The two sections working as mobile units were recalled for work in Gräfelfing (fig. 70). In July 1945, the laboratory was instructed to cease operations, in preparation for re-deployment to the Pacific. However, plans for the laboratory were changed, and work was continued at Gräfelfing. It became the histopathological center for the Eastern Military District. An unusually large backlog of tissue specimens was referred to the laboratory for processing, examination, and ultimate transfer to the Army Medical Museum. By accepting this responsibility, the 7th Medical Laboratory gave some relief to the 4th Medical Laboratory, which was then the theater laboratory. The 4th Medical Laboratory had moved from Paris to Darmstadt, Germany, in the fall of 1945. While in Gräfelfing, the 7th Medical Laboratory evaluated



FIGURE 69.—Base section of the 7th Medical Laboratory in Gräfelfing, Germany.



FIGURE 70.—Laboratory truck of the 7th Medical Laboratory, serving with the Third U.S. Army in southern Germany.

a dental laboratory truck for use as a laboratory vehicle and found it satisfactory.¹⁰⁹

The Pathology Section, 7th Medical Laboratory, reported the growing importance of diphtheria, with its complication of myocarditis, as overshadowing hepatitis and tuberculosis. The frequency of coronary artery disease among soldiers was impressively high. Abundant material for medicolegal and toxicological studies was encountered in cases of obscure traumatic death as well as methyl alcohol poisoning.

The 7th Medical Laboratory was credited with participation in five

¹⁰⁹ Annual Report, 7th Medical Laboratory, 1945.

of the major campaigns in ETOUSA and received the Meritorious Service Plaque for its contributions during the latter months of 1944.

The 10th Medical Laboratory.—The 10th Medical Laboratory was activated by General Orders No. 85, Headquarters, Third U.S. Army, dated 6 August 1942, at Fort Sam Houston. However, the unit did not depart for staging and ultimate embarkation for overseas assignment until 16 February 1944. This long period of training was welcome and valuable to the unit, as described in reports covering the early history of this laboratory.

There were opportunities for participating in the Louisiana maneuvers, for training as a unit, and for sending personnel to the Army Medical School and other schools for special training. Maj. (later Lt. Col.) Cornelius A. Hospers, MC, took command within the first week after the unit was activated. His reports state that this long training period would have been used even more profitably had there not been such a large turnover in personnel. Circumstances demanded at times, however, that personnel from the 10th Medical Laboratory be transferred to units either preparing for training or preparing for overseas shipment.

Training aids were in short supply, and this proved to be a serious deficiency, particularly during the period at Fort Sam Houston. During the Louisiana maneuvers, because there was a shortage of laboratory equipment, the unit, as such, could not be tested adequately in the field, and some of the laboratory work had to be taken to, or performed at, the Camp Polk Station Hospital. Satisfactory bacteriological work could not be performed when the laboratory was set up in tents, and this fact was mentioned in the report of this and most of the medical laboratories. It was readily apparent that Colonel Hospers had set high standards for his unit and did his utmost to conserve both material and manpower.¹¹⁰

The 10th Medical Laboratory began its overseas service with the First U.S. Army which was stationed at Sursley, England. During this period, technicians were sent to the 1st Medical General Laboratory for special training. The laboratory reached the Continent on 17 June 1944, with that segment of the channel-crossing operation which landed at Omaha Beach. Full operation of the laboratory was delayed because important items of equipment were lost in transit from England. Among the initial examinations performed were autopsies on two Medical Department soldiers who had succumbed to methyl alcohol poisoning. Service to adjacent hospitals in the LaCombe area occupied the laboratory during its initial period of operation. During its first month, the laboratory functioned at 60 percent above expected capacity. Much of the work in bacteriology concerned war wounds, and the Toxicology Section was kept busy, particularly with detection of methyl alcohol in beverages. Before leaving this area for Saint-Lô, a museum and medical arts detachment from the Army Medical Museum joined the laboratory. Personnel from the laboratory were detailed to the 4th Convalescent Hospital to assist

¹¹⁰ Annual Report, 10th Medical Laboratory, 1943.



FIGURE 71.—Accommodations which served a unit of the 10th Medical Laboratory in Saint-Lô, France.

the Venereal Disease Section. In the Saint-Lô location, so much work was referred to the laboratory, that it was ordered to cease service for the Navy, Army Air Forces, Civil Affairs, and other activities in the sector (fig. 71). Work for the Third U.S. Army also was reduced in order that service to the First U.S. Army might be increased to the required level.

With the rapid advance of the First U.S. Army, the laboratory had to move frequently. Because the laboratory lacked sufficient transportation to move all its equipment and supplies and was not able to obtain additional vehicles from the First U.S. Army, movement plans had to be revised. A ruthless survey, eliminating every item that was not absolutely essential to its operation, reduced the bulk, and unit movement could then be effected by using organizational vehicles to shuttle personnel, equipment, and supplies in three echelons. Movement was so arranged that personnel detailed to the first shuttle were operating in the new location before the personnel detailed to the third shuttle closed the facility at the old site and moved to the new location. By September 1944, all elements of the laboratory were ideally located at Eupen, a few miles from the Belgian-German border, in a building that the Germans had used to house the chemistry department of the Technische Hochschule of Aachen. It was, therefore, admirably suited for laboratory work.

Launched on 16 December 1944, the *Wehrmacht* attack through the Ardennes Forest in the Battle of the Bulge made it necessary for the laboratory to move back to a safer location. It became functional again in a schoolhouse in Villers-le-Peuplier, a suburb of Hannut, northwest of Huy, Belgium. Facilities were primitive, and all water had to be obtained from the village pump and carried to the laboratory.¹¹¹ The work in this location was dominated by the problems of diarrhea among Army troops and diphtheria among civilians. With the crushing of the German offensive and the renewed advance of Allied Forces to the Rhineland, in early February 1945, the unit moved back to Eupen.

In that month, there were frequent consultations with Colonel Gordon, Chief of Preventive Medicine, ETOUSA, and Col. Tom F. Whayne, MC, Chief of Preventive Medicine, Twelfth U.S. Army Group, concerning epidemiological problems in the First U.S. Army area. In early March, typhus was discovered among the civilian population in Aachen, and later in Cologne. Laboratory personnel worked closely on the investigation of the outbreak, with Lt. Col. John C. Snyder, MC, and Maj. (later Lt. Col.) David McL. Greeley, MC, of the U.S.A. Typhus Commission. By the end of March 1945, the laboratory moved again and established itself in Bad Godesberg, Germany. It became more and more occupied with the problems of typhus. Laboratory personnel were assigned to assist in the DDT-dusting program to prevent further spread of the disease. During April 1945, Colonel Snyder and Major Greeley, with assistance from the laboratory staff, collected blood samples for a survey of typhus contacts. Colonel Bauer, Eighth Service Command Consultant, Col. William S. Middleton, MC, Medical Consultant, ETOUSA, and Col. Neil L. Crone, MC, First U.S. Army Medical Consultant, visited the laboratory during the same month. Late in April, the laboratory moved to Jena and assisted in a study of diarrheal disease occurring in the Buchenwald concentration camp. Methyl alcohol poisoning continued to be a serious problem and dominated the work of the Pathology Section.¹¹²

As noted by other laboratories, the volume of work increased after the end of hostilities in May. The laboratory departed Jena and proceeded to Camp Brooklyn for transshipment to the Pacific theater. Many changes of personnel occurred there. Lt. Col. Jesse E. Edwards, MC, assumed command, and among others joining the unit were Capt. William B. Chamberlin, Jr., MC, also a pathologist, and Capt. Paul D. Bartlett, SnC, a chemist. Those relieved of assignment to the 10th Medical Laboratory were transferred to general hospitals in the area. However, this change was temporary and during September 1945, Colonel Edwards was assigned to the 4th Medical Laboratory, Captain Chamberlin to the 241st General Hospital, and Captain Bartlett to the 101st General Hospital.

Throughout the period of duty of the 10th Medical Laboratory, it was

¹¹¹ Annual Report, 10th Medical Laboratory, 1944.

¹¹² Semiannual Report, 10th Medical Laboratory, 1 January–17 June 1945.

clear that its notable service could be credited to the effort which Colonel Hospers made to maintain a fine spirit in the unit. For his meritorious achievement, Colonel Hospers was awarded the Bronze Star on 8 March 1945.

The 28th Medical Laboratory.—The 28th Medical Laboratory was activated at the Army Service Forces Training Center, Camp Barkley, Tex., on 27 November 1944. The first officer to report for duty was Maj. William E. White, MC, who assumed command on 29 November. The remaining staff members were assigned to the unit soon thereafter. There was no time for unit or other training since the laboratory was expected to depart from New York on 17 December, which it did. Because of this, training schedules were instituted aboard ship. Upon arrival in England, the unit entrained for Salisbury, where it was quartered with the 1st Medical General Laboratory. An outbreak of dysentery occurred among officers using the mess of the 1st Medical General Laboratory, and among those hospitalized were five officers of the 28th Medical Laboratory, including the commanding officer. Maj. Joseph E. Imbriglia, MC, then assumed command. He had to appoint a new laboratory staff since the unit was expected to depart for duty in France. The laboratory left Salisbury on 18 March, debarked at Le Havre, and proceeded to Camp Twenty Grand. At this point, the unit again came under the command of Major White. It proceeded through Belgium and on to Bergheim, Germany, where the unit went into operation on 1 April 1945, serving hospitals of the Fifteenth U.S. Army. A mobile section of the laboratory moved to Bad Kreuznach in June. Repeated moves had prevented full operation of the 28th Medical Laboratory as a unit, and in mid-June, it was selected for redeployment to the Pacific theater. The principal activities of the 28th Medical Laboratory, while in Europe, consisted of support to hospitals and the investigation of dysentery outbreaks.¹¹³

Following arrival on Luzon in the Philippine Islands, the laboratory was transshipped to Okinawa in late 1945. The service of the 28th Medical Laboratory in the Pacific is recounted in another section.

The 361st Medical Laboratory.—The 361st Medical Laboratory was activated at Camp Ellis, Ill., on 22 July 1944 and was permitted little time for training since it had been alerted for overseas shipment less than 2 months later. On the staff with Lt. Col. Joseph D. Aronson, MC, the Commanding Officer, were 1st Lt. (later Capt.) George Margolis, MC, pathologist; 1st Lt. (later Capt.) Joseph H. Arnette, SnC, biochemist; Capt. Guy C. Albaugh, SnC, bacteriologist; and Capt. Bernard Koch, VC. The unit departed Camp Ellis on 4 September for transshipment to Europe via the New York port of embarkation. It proceeded to Clichy, near Paris, to relieve a detachment of the 1st Medical General Laboratory which had been assigned temporarily to the 108th General Hospital. Because space at the 108th General Hospital was insufficient, the laboratory accepted

¹¹³ History of the 28th Medical Laboratory, 27 Nov. 1944–11 June 1945.

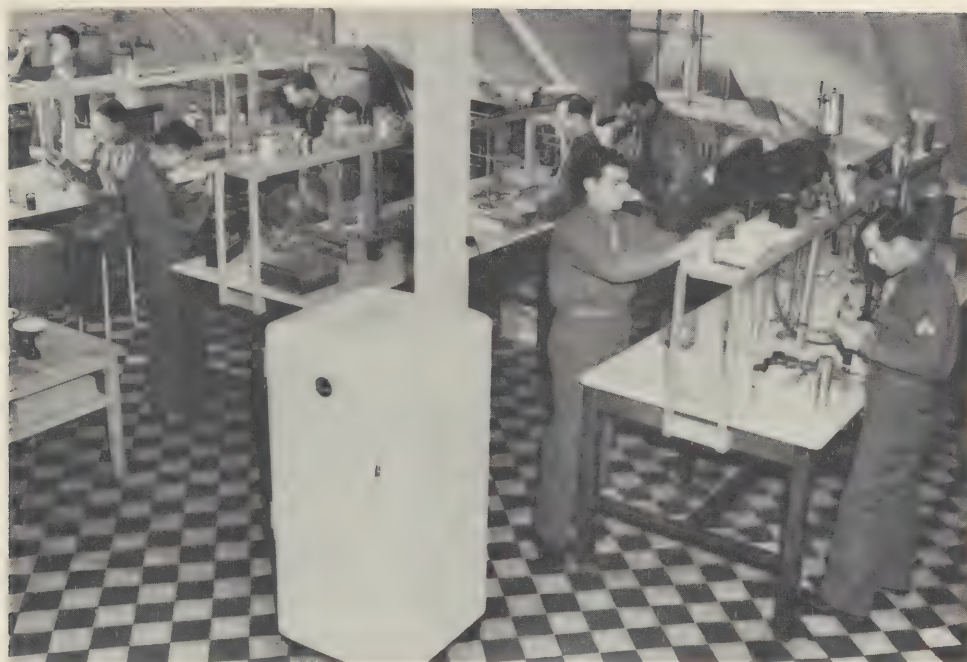


FIGURE 72.—The Serology Section, 361st Medical Laboratory, occupied an upper floor of the Pasteur Institute.

the generous invitation of the Pasteur Institute to use accommodations offered by Dr. Dujaric de la Rivière, General Secretary of the Pasteur Institute (fig. 72). This transfer was completed on 15th December 1944. Upon the reassignment of Colonel Aronson, Lt Col. (later Col.) John B. Hazard, MC, assumed command on March 1945.

As mentioned earlier, a move by the 1st Medical General Laboratory to the Continent in early 1945 was regarded as essential if it were to serve the European theater better. Arrangements for the 1st Medical General Laboratory to trade quarters and accommodations with the 361st Medical Laboratory were accomplished during the last week of March 1945. The 361st Medical Laboratory left Paris for Salisbury, where it shared quarters with the 127th Station Hospital. These units were placed under a single command on 27 April 1945. The laboratory became a unit of the 802d Hospital Center in May. In June, Major Shukers assumed command of the 361st Medical Laboratory upon the reassignment of Colonel Hazard. In the same month, orders were received to cease operations and to prepare for redeployment to the Pacific. An intensive program was undertaken in preparation for redeployment.

The laboratory's operations while on the Continent consisted primarily of service to hospitals and dispensaries and distribution of diagnostic

biologicals to medical units. However, insufficient numbers of laboratory animals proved a problem since mice were often unobtainable, and guinea pigs and rabbits were in short supply. Occasionally, specimens had to be shipped from Paris to the 1st Medical General Laboratory in Salisbury, but this seldom was done because of frequent delays in communications. The 361st Medical Laboratory functioned and served better at the United Kingdom base because of ready availability of supplies, equipment, and animals.¹¹⁴

The 362d Medical Laboratory.—The 362d Medical Laboratory was activated on 22 July 1944 at Camp Ellis, Ill., and placed under the command of Lt. Col. (later Col.) Gerson R. Biskind, MC. The training period was limited to 4 weeks, following which it was transshipped to England, where it arrived on 1 October 1944. The 362d Medical Laboratory was quartered initially with the 1st Medical General Laboratory and remained on this post until mid-November, when it was assigned to the Ninth U.S. Army, departed for France, and arrived at Rouen on 29 November 1944. After being quartered temporarily with the 28th Station Hospital, the unit began operations with a full complement of personnel, equipment, and vehicles on 24 December 1944. However, forward movement of the Ninth U.S. Army was rapid, and during this period, operations were limited to support of field and evacuation hospitals and other medical units. Units of the laboratory were set up, successively, in Wittem, Holland, and in Helenabrunn, Beckum, and Helmstedt, Germany. To function with the advancing army, the laboratory operated in two independent sections. This arrangement was found to be the most efficient, as was reported also by other medical laboratories. On 30 May 1945, the laboratory received orders for direct redeployment to the Pacific theater.¹¹⁵

The staff called particular attention to renal lesions which occurred in transfusion reactions and as a reaction to sulfonamides. During approximately 5 months of operation, the laboratory performed 47,792 examinations. The Serology Section performed the largest volume of work, with bacteriology and pathology representing second and third.

During its period of active service, the 362d Medical Laboratory encountered few obstacles and experienced few interruptions in its operations. However, the unit did find itself short of electrical power periodically, since it possessed but one 3-kilowatt motor generator and for full operation of the laboratory equipment approximately 20 kilowatts were required. The unit was confronted immediately with the need for transformers to convert the 220 volts used on the Continent to the 110 volts required by the laboratory equipment. Reagents were not available for some of the relatively simple and common toxicological tests. There was often insufficient volumetric glassware for chemical analysis. The Pathology Section regarded a freezing microtome as essential to its work, as

¹¹⁴ History of the 361st Medical Laboratory, 22 July 1944–12 Nov. 1945.

¹¹⁵ Annual Report, 362d Medical Laboratory, 1945.

did the 4th Medical Laboratory, mentioned earlier. Transportation was adequate when the laboratory functioned as a single unit but, when functioning as two units, which was often necessary, the transportation available prevented the operation of an effective courier system. Recommendations concerning transport requirements were valuable guides to the Laboratories Division as well as to other divisions in the Surgeon General's Office. They formed the basis for modifications in tables of organization and equipment and also of supply lists (pp. 426-450).

Pacific Ocean Areas

Introduction.—The vastness of the geographic area which comprised the military operations scene in the Pacific Ocean led to its division into the Central Pacific, the South Pacific, and the Southwest Pacific Areas.

In the Central Pacific Area, the 14th Medical Laboratory was activated from the staff of the Central Pacific Area Laboratory in Hawaii. It was assigned later to the Tenth U.S. Army and served on Okinawa. The 18th Medical General Laboratory, under Colonel DeCoursey, succeeded it as the laboratory serving the Central Pacific Area.

In the South Pacific Area, the only medical field laboratory assigned to the area was the 6th Medical Laboratory which arrived on Guadalcanal on 16 February 1943. It operated as a regional laboratory, serving a large number of hospitals on islands in a wide radius from Guadalcanal.

The Southwest Pacific Area was served by three medical field laboratories, the 3d, 5th, and 8th Medical Laboratories.

The common practice in the Pacific was to have a mobile section of a medical field laboratory operate for long periods at great distances from its base section. As the campaign was reaching a climax in 1945, more laboratories were moved to the Pacific so that by the late summer of 1945, there were 10 medical field laboratories and two medical general laboratories, the 18th and 19th, serving the Pacific Ocean Areas. Among the medical field laboratories added were the 28th, which arrived from Europe, and the 12th, 14th, 26th, 27th, and 363d Medical Laboratories. Since geographic circumstances usually required the sections of these laboratories to operate as isolated units, less definitive work could be carried out by any one of them, and the work range of each was rather limited. For example, some mobile sections of the medical field laboratories worked primarily on malaria, bacillary and amebic dysentery, or other special disease problems of the area.

Colonel Thomas, who had been the consultant in medicine in the Fourth Service Command, and who served later as a theater consultant in the Southwest Pacific Area, felt strongly that each theater should have a laboratory consultant. By intent, if not by directive, the commanding officer of each medical field, or medical general, laboratory serving a theater was to be the theater's laboratory consultant. Reports of the

clinical consultants, however, indicate that laboratory commanders were seldom regarded as having this position or capacity. For example, some theater medical consultants wanted a laboratory officer assigned to their staffs and preferred having reports of hospital laboratories sent to the office of the theater medical consultant rather than to the theater laboratory commander. Reports of the theater medical consultants in the Southwest Pacific Area showed that even they had difficulty functioning in a manner appropriate to their positions. These medical consultants were often confined to their assigned bases and were not permitted the freedom of travel required by their mission. Under these circumstances, the commanding officer of a theater's medical laboratory could not establish with the clinical consultants the type of liaison needed to develop an effective laboratory organization. Although the medical consultants considered the work carried out by the medical field laboratories to be of high quality, they regarded that done by the hospital laboratories as inadequate. Neither did the medical field laboratories have direct official contact with the hospital laboratories nor was such contact encouraged, a situation which appears to be an unfortunate interpretation of the mission of these laboratories. A better understanding of the consultants' role as a group would have produced much better medical and laboratory services.¹¹⁶

As reported by Col. Benjamin M. Baker, MC, who was the theater medical consultant for the South Pacific Area, no laboratory consultant was designated in that area for a long time, despite the great need.¹¹⁷ Because there was a shortage of competent laboratory officers and technicians, Colonel Baker exercised close and constant supervision over the laboratories. When the 6th Medical Laboratory arrived on Guadalcanal in 1944, its commanding officer, Col. Jacob A. Sheinkopf, MC, was appointed laboratory consultant for the forward area in addition to his other duties. Because additional laboratory facilities were needed in the forward area, new provisional units were formed within the command, one of which was under the direction of Capt. (later Maj.) Max Michael, Jr., MC, who had been serving with the laboratory of the 18th General Hospital. The laboratory unit under Captain Michael contributed greatly to the high quality of medical care that was given patients in the Bougainville operation (map 11).

In the Central Pacific Area, upon the arrival of the 18th Medical General Laboratory on Hawaii, its commander, Colonel DeCoursey, was designated as laboratory consultant in the Office of the Surgeon for the Mid-Pacific portion of the theater. However, the 18th Medical General

¹¹⁶ Thomas, Henry M., Jr.: Southwest Pacific Area. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants. Washington: U.S. Government Printing Office, 1961, ch. V.

¹¹⁷ Baker, Benjamin, M.: South Pacific Area. In Medical Department, United States Army. Internal Medicine in World War II. Volume I. Activities of Medical Consultants. Washington: U.S. Government Printing Office, 1961, ch. VI.

Laboratory was to serve the western sector of the Central Pacific Area as well.

The 3d Medical Laboratory.—The 3d Medical Laboratory, which operated in the Southwest Pacific Area, was divided into various sections and detachments, the type of laboratory work varying with the location and size of the detachment (fig. 73). The laboratory was initially under the command of Colonel Council, and detachments were commanded by Capt. George P. Smith, MC; Capt. (later Maj.) Austin J. Corbett, MC; Capt. (later Maj.) Kenneth R. Cross, MC; Maj. (later Lt. Col.) James H. Park, MC; and Maj. George T. Crout, MC. The base section of this laboratory was stationed at Dobodura, New Guinea, early in 1944.

Major Park was transferred from the 3d Medical Laboratory to assume command of the 5th Medical Laboratory. His position was filled by Maj. (later Lt. Col.) Charles A. Armbrust, MC. Capt. (later Maj.) Edwin N. Irons, MC, of the 5th Medical Laboratory, was transferred to the 3d Medical Laboratory. Many changes were necessary as new medical field laboratories arrived in preparation for movement to the Philippines.

Throughout island campaigns, major efforts were concentrated on malaria, amebic and bacillary dysenteries, hepatitis, diphtheria, poliomyelitis, filariasis, and schistosomiasis and other helminthic infections.¹¹⁸

The 5th Medical Laboratory.—The 5th Medical Laboratory departed for the Southwest Pacific Area from Fort Mason, Calif., on 27 June 1943, under the command of Lt. Col. Albert M. Richmond, MC. The unit arrived in Brisbane, Australia, on 13 July and was transshipped to Milne Bay, New Guinea, which it reached on 21 August. The high temperature and humidity there caused rapid growth of pigmented fungi on leather and damp clothing. If not protected by oil or grease, metal parts could rust overnight.¹¹⁹

Early in 1944, Colonel Park assumed command of the laboratory. A mobile section was placed under the command of Maj. Allan P. Skoog, MC. Both the base and mobile sections were occupied primarily with enteric and wound bacteriology, serologic tests for syphilis, malaria diagnosis, and teaching assignments at the School of Tropical Medicine which had been organized at the New Guinea base for the training of officers and enlisted men.¹²⁰

In April 1945, the laboratory moved from Milne Bay to Finschhafen, New Guinea. Major Pappenheimer was in command at that time, Colonel Park having been detailed for temporary duty in the Philippines. During its first month in Finschhafen, the laboratory investigated an outbreak of acute food poisoning that occurred in the 22d Troop Carrier Squadron. Epidemiological evidence suggested ice cream as the cause. Abundant growth of staphylococci was obtained in cultures of the ice cream. Filtrate

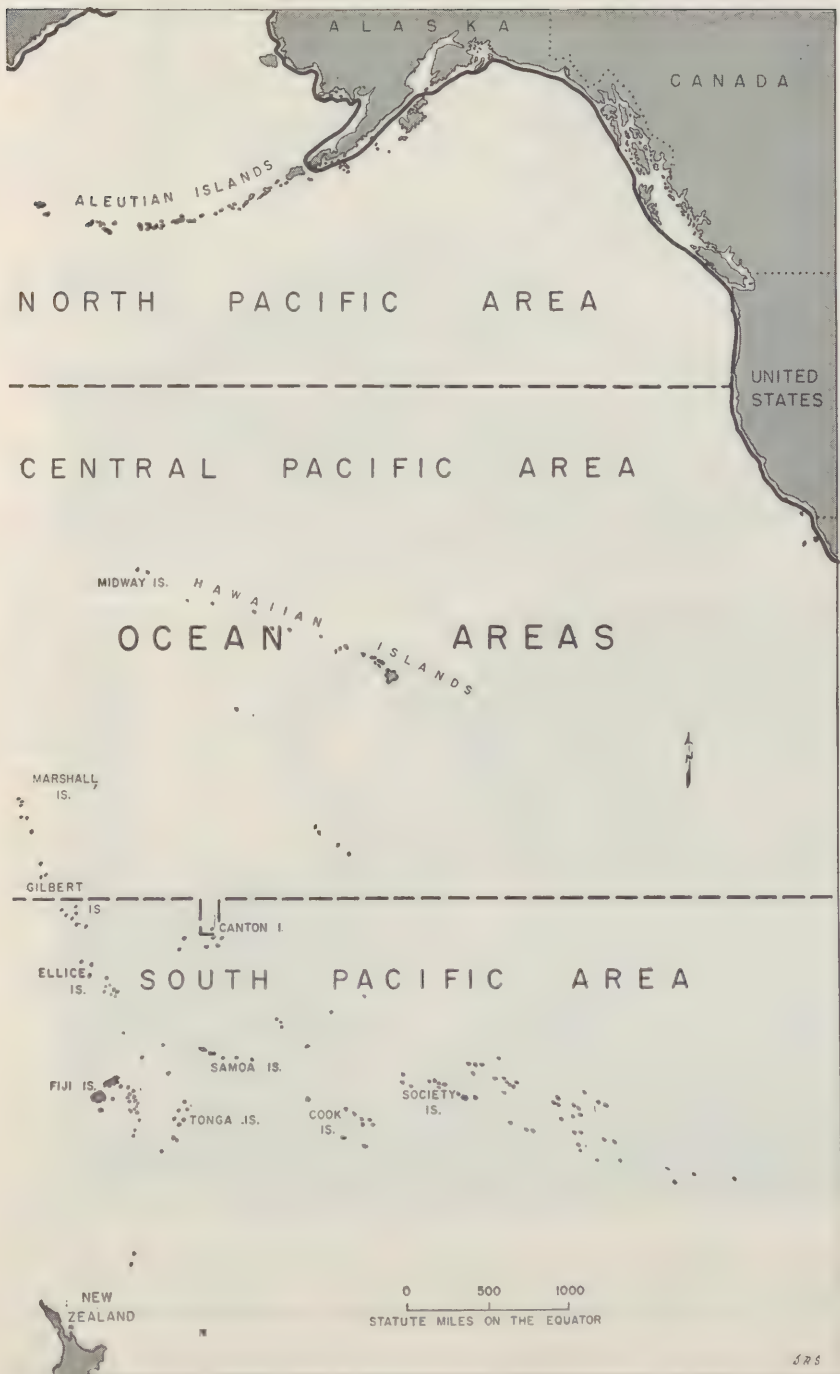
¹¹⁸ Quarterly Reports, 3d Medical Laboratory, 1 Jan.–31 Dec. 1945.

¹¹⁹ Quarterly Report, 5th Medical Laboratory, July–September 1943.

¹²⁰ Quarterly Report, 5th Medical Laboratory, 3 Apr. 1944.



MAP 11.—U.S. Army commands in the



Pacific Ocean Areas, February 1943.



FIGURE 73.—A detachment of the 3d Medical Laboratory stationed at Port Moresby, New Guinea, in July 1943. (Top) Exterior of the building which served as the detachment's laboratory. (Bottom) The chemistry and serology sections.

of broth cultures of the staphylococcus produced vomiting and prostration in young kittens, thereby establishing enterotoxic properties of the organism.

Another outbreak of acute gastrointestinal disease struck the 22d Troop Carrier Squadron during the same month. Vomiting and prostration followed the drinking of gin flavored with fresh lemon juice and sugar. Because of the large number affected, and because symptoms appeared as early as 15 minutes after ingestion, the lemon juice and its container were suspected as a possible cause of the acute poisoning. Capt. J. Gruber, MC, of the squadron, submitted the container and lemon juice for analysis. Qualitative tests with hydrochloric acid and hydrogen sulfide convinced Major Pappenheimer and Capt. (later Maj.) David Ehrlich, VC, that cadmium caused the poisoning.¹²¹

The 5th Medical Laboratory served later in the Philippines and also in Japan.

The 6th Medical Laboratory.—The activities of the 6th Medical Laboratory and its service in the South Pacific Area are recorded instructively, vividly, and in detail by Capt. Roderick Murray, MC.¹²² His account describes the diseases encountered as well as the difficulties in studying them. The laboratory reached Guadalcanal on 16 February 1944. Until its arrival, all hospitals had been improvising in order to equip themselves for the laboratory services they were expected to provide. The smaller hospital laboratories were able to perform the simpler procedures in bacteriology, hematology, and clinical chemistry, but for other laboratory work, they had to refer their specimens to the nearest general hospital laboratory.

The arrival of the 6th Medical Laboratory was welcomed by all of the hospitals since they could now be served by a single reference laboratory. Difficulties were encountered in setting up pathology facilities, however, and in the early months of 1944, it was necessary for the 6th Medical Laboratory to send specimens directly to the Army Medical Museum. Many of the disease problems encountered in the Southwest Pacific Area were met also in this sector of the South Pacific Area. The commanding officer during much of the laboratory's operation was Colonel Sheinkopf. Although the laboratory was designated to serve the entire South Pacific Area, this assignment had to be shared, and arrangements were made for the larger hospital laboratories to serve on a regional basis also. Upon its arrival in Hawaii in August 1944, the 18th Medical General Laboratory became the reference laboratory for the South Pacific Area as well as the Central Pacific Area.

The 8th Medical Laboratory.—The 8th Medical Laboratory was organized at Camp Rucker, Ala., on 15 July 1942, under the command of Maj.

¹²¹ Report, Maj. A. M. Pappenheimer, SnC, and Capt. David Ehrlich, VC, U.S. Army, subject: Investigation of Suspected Cadmium Poisoning Outbreak in Air Corps Unit, 1 May 1945.

¹²² Murray, Capt. Roderick: Laboratory Service-South Pacific Area. Inclosure 1 thereto. [Official record.]

(later Lt. Col.) Kenneth M. Brinkhous, MC. Others in the unit when first organized included: Colonel (then Major) Sheinkopf; Capt. Frank R. Kinberger, MC; 1st Lt. (later Capt.) Harry E. Ewing, Jr., SnC; 1st Lt. (later Capt.) Nathaniel B. Kurnick, MC; and Capt. (later Maj.) Absalom B. Rich, Jr., VC. In the following month, the 8th Medical Laboratory was transferred to Fort Sam Houston to enter a prolonged training period, during which time officers and enlisted men attended schools and visited other training installations.

Many units were being activated in the fall of 1942, and there was a rapid turnover of officer and enlisted personnel. In commenting on this period, Colonel Brinkhous stated that, despite the long period of preparation, his organization had not trained as a unit and that there had been little opportunity for functional training as a medical field laboratory. The laboratory was alerted for overseas movement in May 1943, a notice which came as a surprise. There had been little unit and no maneuver training, but of all of the laboratories training at Fort Sam Houston, the 8th Medical Laboratory was selected because it was considered to be the best trained and best prepared for overseas shipment.

Colonel Brinkhous recommended that in a training area for medical laboratories a full colonel should be in command of the training center to provide overall guidance on the organization and the training of units. Such a director of training should be free of commitments to any one of the laboratories in training. He suggested that Reserve units of the medical field laboratory type be activated in medical centers in the larger cities. A period of 4 months' training was considered adequate for a field medical laboratory and should be carried out at an installation well equipped with training facilities for such units.

Upon arrival in Australia on 15 August 1943, the 8th Medical Laboratory set up its headquarters in Brisbane, with an advance section assigned to Townsville. The base section, with laboratory headquarters, departed from Brisbane for New Guinea in August 1944, and established a system of service to medical field laboratory detachments and to station and general hospital laboratories. One of the detachments of the 8th Medical Laboratory, ordered to Biak Island under Captain Kinberger, prepared for a new base of operations there (fig. 74). Other units followed, and ultimately the laboratory was in full operation in a former jungle site. After 6 months in this location, mobile sections were sent ahead to Luzon, where one operated at San Fabian, and the other at San Fernando. With an outstanding service record, the 8th Medical Laboratory ceased operation in December 1945.

In his report for the second quarter of 1944, Colonel Brinkhous noted that Maj. Harry E. Carnes, MC, a member of the laboratory staff, visited the Brisbane office of the British Medical Association to inquire about the grave of Joseph Bancroft who discovered the adult forms of the filaria with which his name was to become identified, *Wuchereria bancrofti*. The



FIGURE 74.—Blood bank operated by the 8th Medical Laboratory while stationed on Biak, Netherlands East Indies, in January 1945.

Brisbane office had no information on the matter, but Dr. A. Murphy, a Brisbane physician, recalled seeing Bancroft's grave at the Toowong cemetery in Brisbane when, as a boy, he had cycled through. Major Carnes was referred to the sexton of the cemetery and to the recorder of births, deaths, and marriages. There was on record the death of Joseph Bancroft who had been born in Manchester, England, in 1836, and who had died in Brisbane on 16 June 1894. He had lived in Brisbane for 30 years before his death. Mr. Lloyd, the sexton of Toowong cemetery, showed Major Carnes the plot where Dr. Bancroft, his wife, and other members of the Bancroft family were buried.¹²³

The 12th Medical Laboratory.—The 12th Medical Laboratory was activated on 12 February 1945 at Fort Lewis, Wash., under the command of Maj. (later Lt. Col.) John K. Stewart, MC.¹²⁴ There was 1 month of individual training followed by 2 weeks of field training and 6 weeks of parallel training. Much of the training was given at the Madigan General Hospital and the Ninth Service Command Branch Laboratory. The unit departed from Seattle, arriving at Saipan on 9 July 1945, where it was quartered with the 5th Convalescent Hospital. Plans to construct a lab-

¹²³ Quarterly Organizational History, 8th Medical Laboratory, 1 April–30 June 1944.

¹²⁴ History of the 12th Medical Laboratory, 12 Feb.–15 Dec. 1945.

oratory for this unit were not pursued because the Japanese surrender was imminent. During this time, however, the laboratory staff participated in the work of the 217th Malaria Survey Detachment, which went to Peleliu, Angaur, and Garakayo Islands to study insects of medical importance. Other members of the staff assisted in the work of the 369th Station Hospital. Following a visit by Colonel DeCoursey of the 18th Medical General Laboratory, Major Stewart was appointed chief laboratory consultant for the Western Pacific Base Command. During the last phase of the laboratory's operations, Major Stewart visited laboratories in the Command to survey needs for personnel, supplies, and equipment.

The 14th Medical Laboratory.—The 14th Medical Laboratory had its origins in the Central Pacific Area Laboratory at Hawaii and was assigned to the headquarters of that command on 30 June 1944. The Central Pacific Area Laboratory was the successor to the Hawaiian Department Laboratory which had been activated on 18 March 1941. The 14th Medical Laboratory was relieved of its area responsibilities when the 18th Medical General Laboratory arrived in Hawaii in August 1944.¹²⁵

In January 1945, the 14th Medical Laboratory was assigned to the Tenth U.S. Army and shipped to Okinawa. By 22 July, the laboratory was in full operation; however, it functioned for only 1 month before closing for transfer to Korea, where it established operations at the College of Technology in Seoul University. While the laboratory was in Hawaii and Okinawa, it was under the command of Lt. Col. Clarence S. Moran, MC. On 27 August 1945, Maj. Abram S. Benenson, MC, assumed command. Capt. Emanuel S. Cooper, VC, succeeded in command on 19 December 1945.¹²⁶

The history of the 14th Medical Laboratory indicates that it never operated at its expected capacity because it was never at full strength. Despite this handicap, the laboratory gave a good account of itself as the only laboratory on Okinawa, where it served many hospitals and other units during that operation. For its brief but exemplary service during the Okinawa campaign, the 14th Medical Laboratory was awarded the Meritorious Service Unit Plaque under General Orders No. 6, Headquarters, U.S. Army Command No. 24, dated 22 January 1946.

Although a wider range of function of the 14th Medical Laboratory had been desired by its staff during its service in Okinawa, the laboratory was utilized by the command primarily to supplement the limited facilities of the field hospitals. This arrangement could not be considered appropriate under circumstances which found this medical field laboratory at inconvenient distances from the hospitals which it was expected to support. Delays in receiving specimens, occasional loss or damage of specimens, and delays in reporting resulted. It was thought that the presence of a

¹²⁵ Annual Report, 14th Medical Laboratory, 1944.

¹²⁶ (1) History of Medical Activities, 14th Medical Laboratory, 1 July–30 Sept. 1945. (2) History of Medical Activities, 14th Medical Laboratory, 1 Oct.–31 Dec. 1945.

medical field laboratory should not lead to an undue dependence of a hospital upon such a laboratory, since each hospital was expected to develop its laboratory capabilities to a point of optimum independence.¹²⁷

Under the command of Captain Cooper, the 14th Medical Laboratory in Seoul conducted surveys of Koreans for intestinal parasites and also performed toxicological studies of beverages. In one study of more than 400 specimens of alcoholic beverages, more than 50 percent were found to contain methanol. These findings resulted in a ban on the purchase of native alcoholic beverages by U.S. troops.¹²⁸

The 26th Medical Laboratory.—The 26th Medical Laboratory was activated at Camp Ellis, Ill., on 10 December 1943, and its commanding officer, Maj. (later Col.) William D. Tigertt, MC, joined the unit on 5 January 1944. After a short period of training, the laboratory departed for the Pacific during the same month. It began its overseas service in the Southwest Pacific Area on New Guinea, and was assigned to the Sixth U.S. Army. In the move northward, it was stationed on Luzon soon after the beginning of the Philippines campaign. Until June 1945, the 26th Medical Laboratory was the only medical field laboratory serving on Luzon. Major Tigertt later established the base section in Manila, one mobile section at the Luzon Agricultural School, and another at the Philippine Army Academy at Baguio. The laboratory was given the responsibility for developing a Manila Public Health Department Laboratory which was expected to serve the civilian population following the departure of the 26th Medical Laboratory.

Major Tigertt and his staff served also in other capacities to further health services rehabilitation in Manila. As a recognition of his own administrative capabilities, he was placed in charge of reorganizing the San Lazaro Hospital while he still commanded the 26th Medical Laboratory.

Much of the laboratory's work in Manila related to diarrheal disease and the toxicological analysis of beverages. Of some 700 alcoholic beverages submitted for analysis by the Provost Marshal of Manila, about 2 percent were found to contain methyl alcohol or fusel oil. Surveys of Army units showed a high percentage of amebiasis (more than 20 percent) and also intestinal helminthic infections. Venereal disease diagnosis comprised another major segment of laboratory activity during this phase of its Philippines operations. The large volume of laboratory work required in the field of infectious disease necessitated the establishment of special training courses for enlisted technicians because many were deficient in this part of their training.

The fine performance of this laboratory belied its earlier history, since it did not function as a unit until arriving in the Philippines in late

¹²⁷ Historical data on overseas laboratories, 14th Medical Laboratory, 15 June 1946, by Capt. Emanuel S. Cooper, VC.

¹²⁸ Final Historical Report, 14th Medical Laboratory, 1 January to 31 May 1946.

January 1945. Many of the so-called laboratory officers were young physicians who had had 1 year of general postgraduate training in the form of internships and no training in clinical laboratory work. Such training had to be provided by the senior members of the laboratory. Colonel Tigertt recorded his belief that a medical laboratory should train with the equipment which it is to use ultimately, and that ample provision should be made for such items as folding tables, since work space is at a premium in destroyed buildings and while under tentage.¹²⁹

In September 1945, the 26th Medical Laboratory was transferred to Kobe, Japan. During that period, the unit was commanded by 1st Lt. (later Capt.) Walter J. LaCasse, SnC. Later, the headquarters section of the laboratory was established at Kyoto, with a detachment at Kure. At this phase of its operations in Japan, the laboratory was serving all of the medical installations in southern Japan.

The 26th Medical Laboratory subsequently became the nucleus of the 406th Medical General Laboratory which was to serve the Far East areas in the postwar years.¹³⁰

The 27th Medical Laboratory.—The 27th Medical Laboratory was another of the medical laboratories activated at Camp Ellis, Ill. Under the command of Lt. Col. John W. Leichter, MC, the unit was formed with assistance from the 10th Medical Laboratory at Fort Sam Houston. The laboratory staff of 11 officers and 45 enlisted men trained for 5 months and then departed for New Guinea. In August 1944, the unit arrived at Hollandia, where officers and enlisted men were assigned to hospitals for duty. In November 1944, the laboratory equipment and personnel were shipped to Tacloban, Leyte, in the Philippines.

On Leyte, the services of the 27th Medical Laboratory were needed promptly, and, under 1st Lt. (later Capt.) Joseph J. DiLorenzo, SnC, the laboratory was in operation within the allotted 5 days. Capt. Brooks H. Hurd, MC, was in charge of Parasitology; 2d Lt. (later 1st Lt.) George F. Margonis, SnC, Bacteriology; Capt. Henning H. Thorpe, MC, Hematology; 1st Lt. (later Capt.) John J. Rowe, MC, Pathology; and 1st Lt. (later Capt.) Lawrence E. McEldowney, SnC, Biochemistry. Capt. Peter L. Beal, MC, and Capt. Loren McL. Boon, MC, coordinated the operation

¹²⁹ Quarterly Historical Report, 26th Medical Laboratory, 1 July–30 September 1945.

¹³⁰ In 1946, the 26th Medical Laboratory was transferred from Kyoto to Yokohama, where it was deactivated and the 406th Medical General Laboratory activated. With Colonel Tigertt in command, the 406th Medical General Laboratory moved to Tokyo, serving with distinction as a service and research laboratory until its transfer to Camp Zama, Japan, early in 1956. Its responsibilities were as broad as those of any medical general laboratory. During the Korean War it was active in the investigation of hemorrhagic fever and the diarrheal diseases. Paralleling the importance of the 406th Medical General Laboratory has been the high caliber of its commanding officers. Succeeding Colonel Tigertt was Colonel Hüllinghorst, later to occupy a key position in the Medical Research and Development Division of the Surgeon General's Office. Col. Richard P. Mason, MC, later to become director and commandant of the Walter Reed Army Institute of Research, was the next commander followed by Col. Joe M. Blumberg, MC, who was to become director of the Armed Forces Institute of Pathology. Colonel Blumberg was in charge of the transfer of the 406th Medical General Laboratory from Tokyo to Camp Zama. From this base, it now [1969] supports U.S. operations in South Vietnam and other parts of Southeast Asia.

of the laboratory's several sections. All of the sections were active, with concentration of work on malaria, venereal disease, schistosomiasis, diarrheal disease, and water bacteriology.¹³¹ Visitors to the laboratory in early 1945 included Brig. Gen. Guy B. Denit, Theater Surgeon; General Simmons, Chief, Preventive Medicine Service, SGO; and Colonel Kuhns, of the 19th Medical General Laboratory. During this period, a formal inspection was made by Surgeon General Kirk and his staff.

Of special interest were autopsies performed in cases of schistosomiasis, hepatitis, diphtheria, scrub typhus, amebic abscess, methyl alcohol poisoning, and poisoning related to a local beverage known as "tuba." Assigned to the laboratory for special parasitological studies were 2d Lt. (later 1st Lt.) Lawrence S. Ritchie, SnC; Capt. (later Maj.) Frederik B. Bang, MC; and 2d Lt. (later 1st) Nelson G. Hairston, SnC.

The laboratory was transferred to Otaru, Japan, in October 1945, and occupied quarters at Hokkaido Imperial University in Sapporo. Captain Boon succeeded to command upon the transfer of Colonel Leichter. Although there was still a demand for the many services of the 27th Medical Laboratory, the staff was reduced by a transfer of personnel, and until the end of the laboratory's operation, the volume of work in relationship to the size of the laboratory staff remained unduly high.

The 363d Medical Laboratory.—The 363d Medical Laboratory, under the command of Lt. Col. Norman W. Elton, MC, established its facilities at the University of Santo Tomas in Manila on 13 April 1945. Staff members included Maj. Dominic A. Marion, MC; Capt. Leo Gitman, MC; Capt. (later Maj.) Harold H. Plough, SnC; 2d Lt. (later 1st Lt.) Robert W. Fulton, SnC; 1st Lt. (later Capt.) Jesse T. Littleton III, MC; Capt. (later Maj.) Robert W. Dougherty, VC; 1st Lt. (later Capt.) James C. Harris, SnC; and 2d Lt. Milton Marmell, SnC. Delay in the arrival of the unit's vehicles initially deferred the full functioning of this laboratory.¹³² For its ingenuity in organizing laboratory services under difficult circumstances, the unit was complimented by Maj. Gen. James L. Frink, Commanding General, U.S. Army, Services of Supply, Southwest Pacific Area, during an inspection tour. Among other difficulties was the lack of refrigeration in the Pathology Section, which not only displeased the section itself but also sections in adjacent buildings. Despite this and other obstacles, the laboratory was able to perform almost 30,000 procedures during its first month of operation. What appeared to be an unreasonable requirement was the demand that civilians seeking employment as mess personnel in military and in Red Cross installations had to have two consecutively negative stool examinations before they could be hired. This requirement resulted in almost 5,000 stool examinations in 1 month. As was true in many other laboratories, most of the work of the Chemistry

¹³¹ Quarterly Report, 27th Medical Laboratory, 3 Jan. 1945.

¹³² Report, 363d Medical Laboratory, 20 Sept. 1945.

Section was concerned with the examination of beverages, autopsy specimens, and gastric contents for methyl alcohol.

By the time the laboratory was ordered to cease operations on 1 December 1945, it had accomplished several important investigations and contributed significantly to others. Among these was the careful analysis of deaths due to methyl alcohol poisoning and an analysis of tissues and fluids for methyl alcohol. It was observed in fatal cases that the blood level of methyl alcohol was as high as 2 milligrams per milliliter. Because of the limited information on methods for determining methyl alcohol in tissues and fluids, the laboratory division, under Captain Harris, had to develop a procedure for making these determinations.

Capt. Elliott F. Beach, SnC, contributed importantly to studies of the nutritional status of troops in the Southwest Pacific Area. These studies were performed in conjunction with a nutrition research project conducted at the 26th Hospital Center. Participating hospitals included the 13th, 60th, and 248th General Hospitals. More than 1,100 biochemical examinations were performed in this study, including determination of urinary sodium chloride; vitamin C levels of plasma, whole blood, and urine; and urine levels of vitamin B₁ and vitamin B₂.¹³³

China-Burma-India Theater

The 9th Medical Laboratory.—In the latter months of 1943, the 9th Medical Laboratory trained as a unit at the Desert Training Center in Banning, Calif., in preparation for its assignment, early in 1944, to the China-Burma-India Theater. This period proved to be valuable for the laboratory since it trained as a complete unit and obtained field experience with the supplies and equipment to be used at its overseas station. During the period at the Desert Training Center, Maj. (later Lt. Col.) John L. Arbogast, MC, was in command. His critical analysis of the needs of a medical field laboratory which was to operate in a geographic location demanding a high degree of self-sufficiency proved to be helpful to the 9th Medical Laboratory when it began operations in a primitive area of Assam.¹³⁴

Until the 9th Medical Laboratory arrived, the only other laboratories operating independently of hospitals were those of the malaria survey detachments.¹³⁵ Three such detachments had arrived in 1943. Colonel Van Auken, was in command of the laboratory when it arrived in the theater in February 1944. The unit was assigned to Advance Section No. 2, where it eventually established its services in Chabua, Assam, in northeastern India (fig. 75). Until their own facilities could be placed into operation,

¹³³ Report for History of Medical Department Activities, 363d Medical Laboratory, 21 Sept. 1945.

¹³⁴ Report, 9th Medical Laboratory, 27 Sept. 1943, subject: Medical Laboratory, Army or Communications Zone.

¹³⁵ Van Auken, H. A.: A History of Preventive Medicine in the United States Army Forces in the India-Burma Theater, 1942-1945, part I, pp. 41-42. [Official record.]



FIGURE 75.—The 9th Medical Laboratory, Chabua, Assam. (Top) Laboratory and administrative buildings. (Bottom) Histology unit of the laboratory. (U.S. Army photographs.)

staff members were ordered on detached service to the 111th Station Hospital and the 20th General Hospital. Local epidemiological studies were carried out until August 1944, when the 9th initiated its service on a theaterwide basis from its own facility in Chabua. On 24 October 1944, the China-Burma-India Theater was divided into the India-Burma Theater

and the China Theater. In February 1945, Colonel Van Auken was designated the theater laboratory consultant for the India-Burma Theater. In this position, with strong support from the theater surgeon, he and his staff were able to survey the needs of the laboratories in the theater and provide support where needed.¹³⁶ The stature accorded the commanding officer and his laboratory in this theater represented the attainment of the relationship recommended by the Laboratories Division, a circumstance which was not achieved often enough in the service commands and the other theaters of operations.

In addition to supporting other laboratories and undertaking field investigations, the 9th Medical Laboratory initiated refresher training courses for laboratory technicians. Colonel Van Auken's survey had revealed deficiencies in technician training and experience, particularly in the identification of parasitic helminths and protozoa. The Subcommittee on Dysentery of the Army Epidemiological Board also gave such training in its laboratory while it served at the 112th Station Hospital in Calcutta and at the 20th General Hospital in Margharita, Assam.

The laboratory assisted in scrub typhus studies which had been initiated by the 20th General Hospital staff. These studies were expanded with the arrival of a team, under Col. Thomas T. Mackie, MC, which had been dispatched by the U.S.A. Typhus Commission.

The 9th Medical Laboratory served both the India-Burma and the China Theaters until October 1945, when it ceased operation. Units of the 29th Medical Laboratory, under Colonel Hough, then began their service to these theaters.

The unit was active in the field as well as in the laboratory, which served also as the histopathological center. A total of 11 amebiasis surveys involving more than 6,000 stools were completed. Cutaneous diphtheria occurring in Burma was studied with members of the 20th General Hospital staff, the University of Pennsylvania unit stationed at Margharita on the Ledo Road. Diarrheal disease was investigated at the 14th Evacuation Hospital, another of the Ledo Road hospital units. Amebiasis was a serious problem at the 18th General Hospital, a Johns Hopkins Hospital unit, which was adjacent to the 20th General Hospital. The Veterinary Division diagnosed surra and infectious equine anemia in horses of the 38th Chinese Division at Mogaung, Burma. Among other investigations of infectious diseases, melioidosis was studied and reported. Captured enemy medical equipment, collected by the laboratory staff, was examined and shipped to the Zone of Interior.

The geographic distance covered and the breadth of support rendered made the 9th Medical Laboratory comparable to a medical general laboratory. Difficulties encountered by the laboratory were related to its location at the end of several long supply lines. At times, important

¹³⁶ Letter, Surgeon, Headquarters, Services of Supply, U.S. Army Forces, India-Burma Theater, 19 Feb. 1945, subject: Survey of Hospital Laboratories.

chemicals and other items were either not available or were supplied in quantities too limited. Despite the great distances involved, the laboratory served well, owing in large part to the energy and interest of Colonel Van Auken and Major Arbogast who, as consultants, traveled extensively in this vast theater to apprise hospital and other laboratories of the capabilities and use of the 9th Medical Laboratory.

For its important contributions to the India-Burma Theater in the face of great difficulty, the 9th Medical Laboratory was awarded a Meritorious Service Unit Plaque by the commanding general of the theater on 5 June 1945.

The 29th Medical Laboratory.—The 29th Medical Laboratory was activated at Fort Lewis, Wash., on 11 December 1944, and on 6 January 1945, Colonel Hough assumed command.¹³⁷ After a training period, the unit left the United States on 16 April and arrived in Calcutta on 21 May 1945. Since the laboratory was not needed for broad support of hospitals or other medical units, it was assigned the task of investigating diarrheal disease in the India-Burma Theater. For this purpose, the laboratory was divided into two teams, one stationed in Calcutta and the other in New Delhi. Members of the unit who did not serve on these study teams were detailed for service at the 30th, 198th, and 371st Station Hospitals. Thus, the 29th Medical Laboratory had no occasion to function as a single unit during its tenure of duty in the India-Burma Theater.

In October 1945, when the 9th Medical Laboratory ceased operation, the two units of the 29th Medical Laboratory divided the responsibilities for laboratory work emanating from the India-Burma and China Theaters. Reports indicate that there was little theater laboratory work and that both units of the laboratory were occupied primarily with the diarrheal disease surveys. The veterinary officer was employed essentially as a sanitary inspector of the inbounds restaurants of Calcutta. It is apparent that the studies which were carried out by the staff of this laboratory might have been performed as well, and at much less expense, had individuals or teams been requisitioned from the Zone of Interior. Much of the unit's equipment was never unpacked since most of the required supplies and equipment were already available at the installations where the diarrheal disease surveys were conducted. The unit was inactivated on 15 January 1946.

SPECIAL LABORATORY ACTIVITIES

Army Epidemiological Board¹³⁸

Even during the early phases of the preparation for an anticipated but undated mobilization, the need was recognized for expanded research

¹³⁷ Annual History, 29th Medical Laboratory, 1944.

¹³⁸ The important chapter in military medical history that was added by the Army Epidemiological Board during World War II will appear in volume I of the Medical Department history of World War II, "Organization and Operation of the Preventive Medicine Program."



FIGURE 76.—Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army. Front row, left to right: Col. (later Brig. Gen.) J. S. Simmons, Dr. O. H. Perry Pepper, Dr. A. J. Warren, Dr. E. W. Goodpasture, Dr. F. G. Blake, Dr. O. T. Avery, Dr. K. F. Maxcy, Dr. A. R. Dochez, and Lt. Col. (later Brig. Gen.) S. Bayne-Jones. Second row, left to right: Dr. J. R. Paul, Dr. P. H. Long, Dr. C. M. MacLeod, Dr. T. Francis, Jr., Dr. W. A. Sawyer, Dr. J. Stokes, Jr., Dr. O. H. Robertson, and Dr. M. H. Dawson. (U.S. Army photograph.)

by the Medical Department, its supporting agencies, and civilian scientists. Plans to broaden the research programs were undertaken fully a year before the attack on Pearl Harbor. The Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army (fig. 76), known later as the Army Epidemiological Board, originated in a communication sent by Colonel Simmons to Surgeon General Magee in December 1940. The proposal to establish the board was accepted and relayed by The Surgeon General to The Adjutant General. The board was to consist of outstanding civilian scientists working on the major disease problems of the Army in a pattern which would coordinate efforts of the Army and civilian scientists and their respective research facilities. In response to this communication, on 11 January 1941, by order of the Secretary of War, the plan was approved, and the board was established.¹³⁹

¹³⁹ (1) Memorandum with letter, prepared for the signature of Maj. Gen. James C. Magee, USA, The Surgeon General, 27 Dec. 1940, from Lt. Col. James S. Simmons, MC, for the Chief, Planning and Training Division (thru: Chief, Professional Services Division), subject: Establishment of a Board for the Investigation of Influenza and Other Epidemics in the Army. (2) Bayne-Jones, S.: Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army. Army Medical Bulletin No. 64, October 1942, pp. 1-22.

The plan for such a board, as contemplated by Colonel Simmons, would expand the Army's capability to undertake the control of epidemic respiratory and other diseases to be expected with mobilization and to reduce morbidity and mortality from such causes. The organization that began its work in January 1941 was set up along the lines proposed by Colonel Simmons in his letter to The Surgeon General. It consisted of a central board and a group of civilian consultants organized into commissions and investigative teams. Throughout the war years, the board was under the presidency and direction of Dr. Francis G. Blake, professor of medicine, Yale University.¹⁴⁰ The central board had seven members, and on the 10 commissions there were approximately 100 civilian consultants to the Secretary of War. The 10 commissions then established were: Commission on Acute Respiratory Diseases, Commission on Cross Infections in Hospitals, Commission on Epidemiological Survey, Commission on Hemolytic Streptococcal Infections, Commission on Influenza, Commission on Measles and Mumps, Commission on Meningococcal Meningitis, Commission on Neurotropic Virus Diseases, Commission on Pneumonia, and Commission on Tropical Diseases.

The membership of the central board continued unchanged during 1944-45 with Drs. Oswald T. Avery, Alphonse R. Dochez, Ernest W. Goodpasture, Kenneth F. Maxcy, O. H. Perry Pepper, and Andrew J. Warren as members. Dr. Blake served as president of the board and also as director of the Commission on Epidemiological Survey. General Bayne-Jones was the administrator of the board, and Lt. Col. Aims C. McGuinness, MC, was assistant administrator. In 1944, the Secretary of War authorized an allotment of 25 officer spaces for the Army Epidemiological Board. This allotment was to be filled by the commissioning or the assignment of 20 Medical Corps officers, four Sanitary Corps officers, and one Medical Administrative Corps officer to the board's activities.

The board and its commissions were organically a part of the Surgeon General's Office, administered through the Preventive Medicine Service, and when consultants were called to duty, their orders were issued through the Surgeon General's Office. As individuals and with teams which included Medical Department officers, these consultants worked in camps and on posts in the continental United States and overseas theaters of operations. Commission members also conducted long-term investigations of diseases of military importance in the laboratories of their universities and research institutes.

In addition to conducting a broad program of medical research pertinent to military problems, the board and commissions stood ready to advise and assist The Surgeon General. The board and its research activities have been cited often as a model of successful cooperative wartime enter-

¹⁴⁰ For his service as a medical consultant and as president of the board, Dr. Blake received the Medal for Merit from Surgeon General Norman T. Kirk, on 21 March 1946. On that occasion, General Simmons spoke on the Army's medical research program during World War II (Mil. Surgeon, 99: 1-4, July 1946).

prise between the Surgeon General's Office and the leading civilian medical institutions of the country. Throughout this period of the board's operation, there was coordination also with the Office of Scientific Research and Development; the Committee on Medical Research of the National Research Council; the research installations of the Army, the Navy, and the Public Health Service; governmental departments; scientific societies; and individual scientists engaged in medical research of military importance.

The Commission on Acute Respiratory Diseases, with the Commission on Cross Infections in Hospitals, studied the effects of oiling barracks' floors and of bedclothes on the spread of respiratory diseases. A detergent-mineral oil and water emulsion was found to be satisfactory because of its ease of application and its ability to retain bacteria. No reduction in non-specific respiratory disease could be demonstrated by use of this emulsion, but there was suggestive evidence that less streptococcal disease occurred in the oiled barracks. Maj. John Dingle, director of the commission, visited the European and Mediterranean theaters of operations during the winter of 1944-45 as a consultant on respiratory diseases.

The Respiratory Diseases Commission Laboratory at Fort Bragg, N.C. (fig. 77), was established as a class IV installation of The Surgeon General and served directly under the Commission on Acute Respiratory Diseases.¹⁴¹ This was the only laboratory of its type under the board, since most of the research was conducted under contract in universities, hospitals, and institutes. The initial staff included Major Dingle, as director, and others who began their work at the Fort Bragg installations as civilian scientists, but who were commissioned in 1944 when the War Department established the officer allotment for the Army Epidemiological Board. Among those active at the commission laboratory were Theodore J. Abernethy, Alexander D. Langmuir, George F. Badger, Joseph W. Beard, Norman L. Cressy, Alto E. Feller, Irving Gordon, Charles H. Rammelkamp, James M. Ruegsegger, Elias Strauss, and Hugh Tatlock. In addition to this permanent staff, officers were assigned from other commissions and from other Army installations for short periods of duty in research assignments.

Research work at the Commission Laboratory was supported primarily by the offices of The Surgeon General and the Surgeon at Fort Bragg. Supplemental support was received from a number of other sources, including grants to the board from the Commonwealth Fund, the W. K. Kellogg Foundation, the John and Mary Markle Foundation, the International Health Division of the Rockefeller Foundation, and funds appropriated for the Commission on Acute Respiratory Diseases through a contract with Yale University.

The mission of the laboratory was to (1) maintain continuous observations on respiratory diseases as they occurred at Fort Bragg; (2)

¹⁴¹ Historical Report, Commission on Acute Respiratory Diseases, Board for the Investigation and Control of Influenza and Other Epidemic Diseases, 1 Aug. 1942-1 Dec. 1945.



FIGURE 77.—Respiratory Diseases Commission Laboratory, Fort Bragg, N.C.

maintain constant watch for influenza and to study any outbreaks of this disease; (3) investigate primary atypical pneumonia in all of its aspects; (4) conduct field investigations as required by The Surgeon General. Throughout the period of operation of the laboratory, there was ample opportunity to study the respiratory diseases, particularly primary atypical pneumonia, which at times constituted over 90 percent of the hospital admissions. During the 3-year period covered by the commission's report, there were 4,446 admissions to the Fort Bragg Hospital for primary atypical pneumonia. Attempts to isolate an agent from these cases were unsuccessful. Studies, however, revealed that primary atypical pneumonia could be transmitted by employing bacteria-free filtrates of throat washings from individuals in the acute stage of the disease. Just as clinical features of the natural disease varied, so did the induced infection vary in character and severity (fig. 78). Pursuit of the laboratory's objectives led to the development of better diagnostic procedures for application to the acute respiratory diseases of both bacterial and viral origin.

The Commission on Airborne Infections continued its work on air

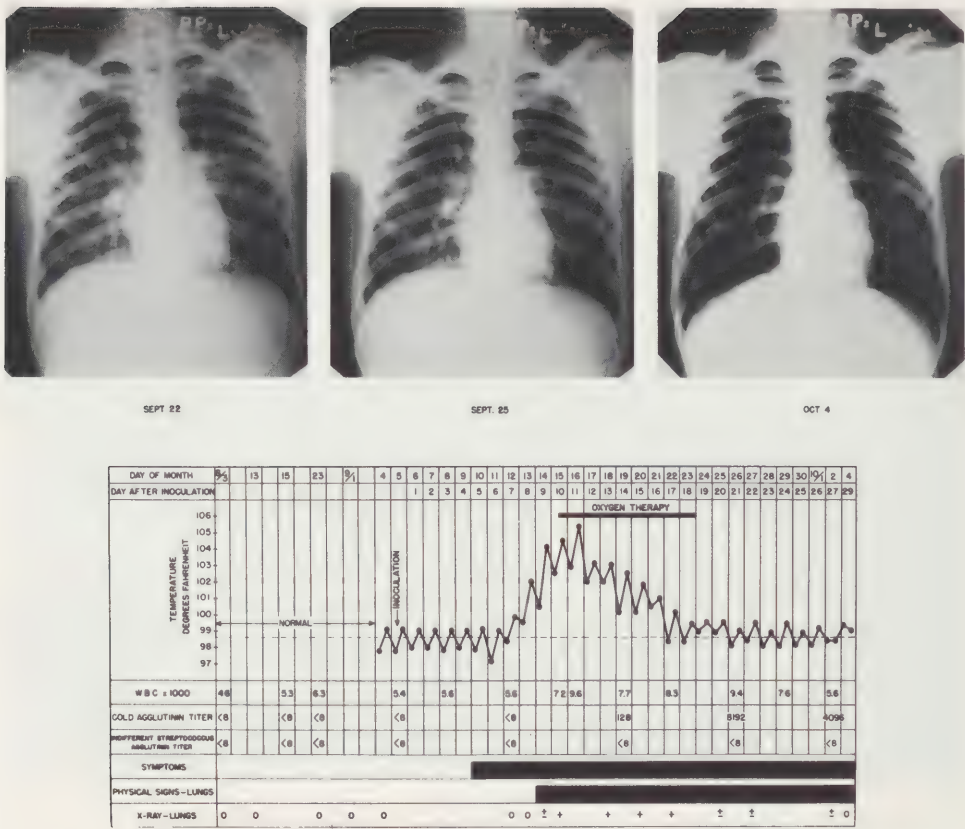


FIGURE 78.—Course of a research volunteer inoculated with material presumed to have the agent of primary atypical pneumonia. This is typical of one of the numerous research projects carried on by the Respiratory Diseases Commission Laboratory at Fort Bragg, N.C.

sterilization through use of glycol vapors. Also studied was the significance of the nasal carrier in the spread of hemolytic streptococcal disease.

Under the sponsorship of the Commission on Epidemiological Survey, Dr. Charles E. Smith pursued a program directed at the control of coccidioidomycosis at the AAF bases in California and at the Desert Training Center on the Arizona-California border. Dr. J. Howard Mueller, of Harvard Medical School, concluded his 4-year study of the bacteriology of throat cultures. Dr. Beard at Duke University continued his work on the purification and concentration of the influenza viruses. Dr. Mueller and Colonel McGuinness visited the European theater to study the growing problem of diphtheria.

At New York University, the Commission on Pneumonia was evaluating the use of penicillin and fibrinolysis in the treatment of empyema.

During 1945, a field study of immunization against pneumococcal infections, using the polysaccharide fraction of pneumococcal types 1, 2, 5, and 7, was conducted with the Office of the Air Surgeon at the Sioux Falls Army Air Field. Strong evidence appeared for the polysaccharide fraction's being a satisfactory immunizing agent. Dr. Colin M. MacLeod, director of the commission, was active in this study and also in investigating respiratory disease outbreaks at several Army posts.

The Commission on Tropical Diseases reported that Dr. Carl Ten-Broeck, Dr. John B. Nelson, and Major Dammin returned, in December 1944, from the India-Burma Theater after completing their study of bacillary and amebic dysentery.¹⁴² A Commission on Schistosomiasis, headed by Dr. Ernest C. Faust, left for the Southwest Pacific Area in May 1945. Members of the commission included Dr. Donald B. McMullen, Dr. Willard H. Wright of the Public Health Service, and Capt. (later Maj.) George W. Hunter III, PhC. The 1944 experience on Leyte had illustrated how a military operation might be disrupted by schistosomiasis, and the commission was assigned to review the hazards which schistosomiasis might present in other parts of the Far East. Whether our military operations might extend westward into China was still uncertain, and it was felt therefore that the japonicum variety of schistosomiasis deserved further and prompt study. The commission established its headquarters at Tacloban, Leyte, and studied schistosomiasis there and on Mindinao until October 1945.

The Army Epidemiological Board continued to serve the Army in the field of preventive medicine into the postwar years. In 1949 it became the Armed Forces Epidemiological Board and therefore a triservice consultant body, and in 1953 it was so chartered by the Department of Defense.

The work and accomplishments of the Army Epidemiological Board and its successor, the Armed Forces Epidemiological Board, have been recounted periodically. A detailed and recent review was prepared by its current executive secretary (Britten, S. A.: Contributions of the Armed Forces Epidemiological Board to Military Progress. *Mil. Med.* 130: 149-157, February 1965). Fourteen commissions serve under the board. The mission of the board, as defined in its charter, calls for those identified with the board and its commissions to: (1) serve as consultants in preventive medicine to the Armed Forces, (2) be prepared to carry out field investigations, and (3) conduct laboratory research to complement or amplify research programs of the military medical services. The board consists of nine members, and its current [1965] membership includes Stanhope Bayne-Jones; Francis S. Cheever; Gustave J. Dammin, president of the board; John H. Dingle; Thomas Francis, Jr.; Richard A. Kern; Albert B. Sabin; Charles E. Smith; and John C. Snyder.

¹⁴² For additional information, see p. 593.

United States of America Typhus Commission

Developments which led ultimately to the formation of the United States of America Typhus Commission originated in plans initiated by Colonel Simmons soon after he joined the staff of The Surgeon General in February 1940. Because of his extensive field and laboratory experience, Colonel Simmons was more aware than most medical officers were of the hazards which the typhus fevers might present, of the research necessary to develop more effective methods of prevention and control, and of the numbers of Medical and Sanitary Corps laboratory officers who would be required for the tasks which had to be undertaken promptly.

The Army's experience with the rickettsial diseases in World War II and the exceedingly important work of the U.S.A. Typhus Commission in the identification and control of typhus is recorded in detail by General Bayne-Jones in volume VII of the preventive medicine history of World War II. The following brief account pertains to some of the medical laboratory research in the rickettsial diseases and presents some of the Typhus Commission's work during the latter years of the war. The field work of the commission is discussed also in other sections of this chapter which describe joint Army-Typhus Commission activities.

In the virus and rickettsial diseases laboratory at the Army Medical School, work on typhus was expanding rapidly in 1940 under the guidance of Colonel Plotz. Laboratory diagnostic procedures were being developed which led to the ready differentiation between epidemic and endemic typhus. Endemic, or murine typhus had been recognized in the Caribbean, and in 1941 its prevalence in Jamaica was high. The identification, by Colonel Plotz and his associates, of the typhus in Jamaica as the endemic, rather than the epidemic, form allayed fears of a possible typhus epidemic there.¹⁴³

In *Rickettsia prowazeki* grown in yolk-sac culture, Colonel Plotz identified a specific cellular substance which proved to be the basis for a more effective typhus vaccine than that in use in early 1942; namely, the Cox vaccine. Almost simultaneously, the value of the same component of this rickettsia in a vaccine was recognized by Dr. Norman H. Topping and Dr. M. J. Shear, working at the National Institute of Health in Bethesda, Md.¹⁴⁴

Talented representatives of the many disciplines needed for the attack on typhus were mobilized rapidly. Working relationships were established by the Preventive Medicine Division, SGO, with the Pan-American Sanitary Bureau; the International Health Division of the Rockefeller Foundation; the Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture; the National Research Council; the U.S. Public Health Service; the American Medical Association; the Office of

¹⁴³ Plotz, H., et al.: Endemic Typhus Fever in Jamaica, B.W.I. Am. J. Pub. Health 33: 812-814, July 1943.

¹⁴⁴ Topping, N. H., and Shear, M. J.: Studies of Antigens in Infected Yolk Sacs. Pub. Health Rep. 59:1671-1675, 29 Dec. 1944.

Scientific Research and Development; and the Bureau of Medicine and Surgery, U.S. Navy. Especially valuable in developing the typhus program were the Public Health Service laboratories which had gained considerable experience in rickettsial diseases. Particularly helpful as representatives of the Public Health Service were Dr. Thomas Parran, its Surgeon General; Dr. Rolla E. Dyer, director of the National Institute of Health; and Dr. Topping, of the institute's Division of Infectious Diseases. Very important for the prevention and control of typhus through vector control was the assistance given in 1941 by Dr. E. F. Knippling, chief of the Bureau of Entomology and Plant Quarantine. Typhus was an interest of several members of the Army Epidemiological Board; Dr. Francis G. Blake, the president of the board, and Dr. Maxcy were to assist the Typhus Commission through field surveys for scrub typhus in New Guinea in 1943. However, the rickettsial diseases were not represented in the commissions under the Army Epidemiological Board, and because of the anticipated importance of the typhus fevers and the need for coordinated assistance from many agencies, it was considered essential that work on typhus be directed by an independent commission.

The step which led to the actual establishment of the United States of America Typhus Commission was taken by Colonel Simmons in August 1942. He recommended the activation of a survey group which would gather data abroad on the distribution and hazard of typhus, thus accelerating the development of a typhus control program. A series of high-level conferences followed, which brought together representatives of The Surgeon General of the Army, the Army Service Forces, the Navy Department, the Federal Security Agency, and the State Department. From these meetings emerged the recommendation that a typhus commission be created. In early December 1942, the Secretary of War authorized the formation of the commission's rear echelon consisting of the Assistant Chief of Staff for Operations, Army Service Forces; the director of the National Institute of Health; and the chiefs of the Preventive Medicine Services of the Army and the Navy. Through this representation of preventive medicine, many laboratory officers were given opportunities to serve with the new commission in its laboratory and field programs. The move to assure top-level status and therefore effective and coordinated operation of the commission was taken by President Roosevelt on 24 December 1942, when he issued Executive Order No. 9285, "Establishing the United States of America Typhus Commission."

The headquarters of the commission was activated in the Preventive Medicine Service, SGO. Colonel Bayne-Jones who, as a member of the Preventive Medicine Service staff, handled certain affairs of the Typhus Commission during the organizational period became director of the commission on 21 August 1943. Rear Adm. Charles S. Stevenson, MC, USN, was the original director but was forced to resign after 1 month because of illness. Col. (later Brig. Gen.) Leon A. Fox, MC, who succeeded

Admiral Stevenson, was relieved as director, at his own request, and became field director of the Typhus Commission in August 1943.

During its 3½ years of service, the Typhus Commission achieved a notable record through the contributions of many highly talented scientists who worked assiduously on each of the many war fronts. One would expect that these scientists, even though, or perhaps because, they were military officers serving with a commission established by executive order, might encounter difficulties in overseas commands. The expected occurred, and how these difficulties were resolved and how much the commission did achieve are detailed by General Bayne-Jones in another volume in this series.¹⁴⁵

During the period that the commission served, the Army assigned 24 Medical Corps and 14 Sanitary Corps officers to the commission. The U.S. Navy assigned 19 Medical Corps officers, and the U.S. Public Health Service, seven officers. Some of the scientific publications prepared by laboratory officers working with the commission are cited in the addendum, pp. 599–603.

The first overseas activity established by the commission was a field headquarters in Cairo, attached to the Office of the Chief Surgeon, U.S. Army Forces in the Middle East. Subsequently, teams or additional field headquarters were activated in Naples, London, Paris, Frankfurt, New Guinea, Manila, Myitkyina (fig. 79), and Tokyo. These facilities were established during the war period, with the exception of the Frankfurt field headquarters, which was opened in November 1945, and the Tokyo field headquarters, which was activated in October 1945. President Harry S. Truman, upon the commission's recommendation, issued Executive Order No. 9680, dated 17 January 1946, "Abolishing the United States of America Typhus Commission," and it ceased operation on 30 June 1946.

Of enduring importance to typhus research as one type of military medical research which deserves to be fostered until no problems remain, is the statement made by General Bayne-Jones in 1944 on the need for postwar research planning. This statement was presented at a hearing of the Senate Subcommittee on Wartime Health and Education, held on 14 December 1944.¹⁴⁶ Of special pertinence to the Army is the recommendation in this statement that Army-related research must be a part of the Army's Medical Department program, since the Army of necessity must continue its long tradition of fruitful work in medical research. At the same time, Army medical research must be an important and active participant in national-scale programs, joining with the country's industries, research foundations, universities, and medical schools on a continuing basis.

¹⁴⁵ Bayne-Jones, Stanhope: Typhus Fevers. In Medical Department, United States Army. Preventive Medicine in World War II. Volume VII. Communicable Diseases. Arthropodborne Diseases Other Than Malaria. Washington: U.S. Government Printing Office, 1964, ch. X.

¹⁴⁶ Unpublished personal communications from Dr. Stanhope Bayne-Jones.



FIGURE 79.—One of the buildings in the research unit established by a team of the U.S.A. Typhus Commission in 1945 at Myitkyina, Burma. (U.S. Army photograph.)

Armored Medical Research Laboratory¹⁴⁷

Another important medical research activity which was to employ the talents of a wide variety of Medical and Sanitary Corps laboratory officers was established at Fort Knox, Ky., to obtain information and guidance about the stresses arising from the man-machine interplay. The awareness of these stresses was relatively new in civilian life in 1940, at which time the Army recognized that mechanization could develop properly only in concert with an understanding of the soldier and his relationship to new weapons and vehicles. Plans for study of these stresses were already germinating when the Armored Force was activated on 10 July 1940. The Armored Force's request for assistance from the Surgeon General's Office and the National Research Council resulted in a meeting on 10 October 1941, at the National Academy of Sciences. The National Research Council's Committee on Industrial Medicine met with Army, Navy, and Public Health Service representatives to hear an account of the Armored Force, as presented by Col. (later Maj. Gen.) Albert W. Kenner, MC, Chief Surgeon, Armored Force. Colonel Simmons, Chief, Preventive

¹⁴⁷ Except as otherwise indicated, material in this section is derived from the following sources: (1) Historical Report, Armored Medical Research Laboratory, 10 Jan. 1946, (2) Cook, W. Leigh: Occupational Health and Industrial Medicine (ch. III, this volume).

Medicine Division, with other members of the division, represented The Surgeon General. The need for a research laboratory was recognized at this meeting and, on 6 December 1941, Maj. Gen. (later Gen.) Jacob L. Devers, Commander of the Armored Force, requested the creation of such a laboratory. On 3 February 1942, the Secretary of War authorized the laboratory as a facility at Fort Knox. In a letter to the Commanding General, Army Ground Forces, dated 4 August 1942, General Devers stressed the prompt need for the laboratory and detailed the manner in which it was to be staffed. The laboratory was completed and occupied the following month. Even before the Research Laboratory was occupied in September 1942, a broad research program had been inaugurated in temporary buildings at Fort Knox and was given high priority. By the time the new quarters could be utilized, much had been learned about vehicle and weapon design which would reduce stresses on the soldier.

A search for top-level competence to direct the Armored Medical Research Laboratory was rewarded by the appointment of Dr. Willard F. Machle and Dr. William B. Bean. Dr. Machle became the commanding officer with the grade of lieutenant colonel (later colonel), and Dr. Bean was commissioned in the grade of major. Major Bean succeeded Colonel Machle as the commanding officer in October 1945. The original staff consisted of 10 officers, representing the talents of medicine, physics, chemistry, physiology, and engineering needed for this new and important research enterprise.

The wide range of studies included the effects of temperature, humidity, and diet on an individual's performance in a combat vehicle. Carefully examined were vision requirements in an enclosed vehicle, accumulation of toxic fumes, methods of fire protection and control, and hazards from noise and blast. Observations were made of field units, such as those in training in Colorado and in combat in the Pacific.

Anthropometric studies and an analysis of the unique requirements of tank crews led to standards for the selection of personnel for the Armored Force.

At the request of The Surgeon General, the laboratory undertook a detailed examination of the relationship of Atabrine (quinacrine hydrochloride) blood levels to the time and dose of drug ingested. Test results formed part of the basis for the Army's malaria suppression program. For example, it was established that in subjects given similar doses of Atabrine, the same plasma level was reached, regardless of whether the subject performed in a hot, humid atmosphere or in a simulated temperate climate.

The laboratory and its accomplishments were sound testimony for the belief that it was practical and necessary to investigate relationships of the soldier to his environment and to the weapons he used. Weapons and vehicles were designed on the basis of the studies conducted in this laboratory, which also established an essential place for research in

mechanized warfare. At the same time, however, the laboratory's experience demonstrated that much of the excellent research which may be carried out by a highly talented staff cannot always be translated rapidly into improved procedures and practices. As one attempt in this direction, the research staff wished to indoctrinate student personnel at the Armored School at Fort Knox so that these students, learning firsthand about the benefits deriving from the research program, could instruct other personnel of the Armored Force. Although this approach would have assured a more rapid dissemination of research information to the field, it was never authorized. Additionally, the staff felt that some of its achievements after taking the form of recommendations, received no attention from higher authority for unnecessarily long periods. There was "lack of an instrument for translating recommendation into accomplishment."¹⁴⁸

Army Industrial Hygiene Laboratory¹⁴⁹

Authority to establish a central Industrial Hygiene Laboratory at the Army Medical Center was given to The Surgeon General by the Secretary of War on 5 January 1942.¹⁵⁰ Before the laboratory could be activated at the Army Medical Center, a War Department general order prohibited the assignment of additional officers to the Military District of Washington, thereby necessitating location of the laboratory outside the District. The generous cooperation of Johns Hopkins University led to an allotment of space in its School of Hygiene and Public Health. The laboratory was transferred to Baltimore promptly, and technical operations were undertaken even before its official activation date of 17 October 1942. The laboratory served as a class IV installation and was designated the 1366th Service Unit, the Army Industrial Hygiene Laboratory. This status and location were maintained until 1 October 1945, when the laboratory was transferred to the Army Chemical Center, Edgewood, Md.

Activated with five Sanitary Corps officers and three civilians, the laboratory's mission was the investigation of occupational health hazards in Army-owned industrial plants, arsenals, and depots, and the sampling of gaseous fumes and other toxic substances which might constitute a danger in these plants. Considerable travel was involved in fulfilling this mission, not only for inspecting industrial and other installations but also in attempting to establish a proper status for the laboratory. The latter was clarified considerably when, in April 1943, the laboratory became a class IV installation under the jurisdiction of The Surgeon General. At peak strength, the laboratory had two Medical Corps officers, 23 Sanitary

¹⁴⁸ Annual Historical Report, Armored Medical Research Laboratory, 10 Jan. 1946, p. 15.

¹⁴⁹ Except as otherwise indicated, material in this section is derived from: Cook, W. Leigh: *Occupational Health and Industrial Medicine* (ch. III, this volume).

¹⁵⁰ Letter, The Adjutant General, to The Surgeon General; The Quartermaster General; Chief of the Air Corps; Chief of the Chemical Warfare Service; Chief Signal Officer; Chief of Engineers; and Chief of Ordnance, 5 Jan. 1942, subject: Policy on Medical Service to Civilian Employees in Army-operated Industrial Plants and Depots.

Corps officers, two Medical Administrative Corps officers, one Women's Army Corps officer (detailed to the Medical Administrative Corps), two enlisted women (WAC), and 19 civilian employees.

The laboratory was commanded initially by Capt. (later Lt. Col.) Henry N. Parrish, SnC, and the professional activities were directed by Dr. Raymond Hussey, a widely recognized authority on industrial medicine. In June 1943, Dr. Hussey became a lieutenant colonel in the Medical Corps and also the laboratory's commanding officer.

Of particular interest and importance to preventive medicine was the work of the Chemistry and Medicine Sections of the laboratory. In visits to industrial activities, members of these sections sought out occupational illness as it might be expected to occur. In the laboratory, they investigated the properties of chemically impregnated clothing and equipment proposed for military use. They were not only concerned about direct toxicity of chemicals used as insect repellents in the treatment of clothing, but also about the skin-sensitizing and other allergenic properties of these chemicals which were efficacious in repelling mites and other disease-carrying ectoparasites. These sections of the laboratory also studied the maximum allowable concentrations of atmospheric contaminants. However, the principal study in the laboratory concerned the toxicity of textiles after impregnation or other treatment with fungicides, insecticides, insect repellents, and flame retardants. Most of the testing was performed in response to requests originating in the Office of The Quartermaster General, but studies were conducted also for the Corps of Engineers, the Ordnance Department, other Army departments, headquarters of service commands, Army Service Forces, and Army Air Forces.

Medical Department Equipment Laboratory

Established at Carlisle Barracks, Pa., on 1 October 1920, the purpose of the Medical Department Equipment Laboratory was to give the Army a laboratory in which equipment might be designed and field tested, and one which would furnish industry with tested designs that could be used when mass production of medical equipment was necessary. Although the development of medical equipment dates back to the Mexican border campaign and World War I, a program was not formulated until the establishment of the Carlisle Barracks laboratory. However, as noted earlier in this chapter, funds and required talent were limited between the World Wars, so that development of field medical laboratory equipment did not progress until 1939. Although the modification of many items was begun in 1939, the progression of world events toward war was so rapid that many laboratories found themselves with obsolete equipment not only during their training period but also during the early periods of their operation in the Zone of Interior and overseas.

During the limited national emergency period and at the outbreak of hostilities, this laboratory was under the command of Lt. Col. (later Col.)

Albert S. Dabney, MC.¹⁵¹ During early 1941, it was occupied with an intensive development program of such items as the mobile surgical hospital, a bus-type ambulance, heated tents for patients, hospital trains, folding litters, the first aid packet, and accessories for the standard litter. Pending definitive development at that time were the portable field autoclave, a new type of shelter tent, winter headgear, and the Army mobile medical laboratory. As development of a particular item reached completion, it was reviewed by a Medical Department board and, if approved, the record of such action was forwarded to The Surgeon General.

With the beginning of hostilities, the tempo of work at Carlisle Barracks was speeded since recommendations for new items of modification of equipment flowed in constantly at that time. Under consideration, for example, was a multipurpose van body which could be mounted on a 2½-ton cargo truck for use as a mobile ward or aid station. As the experience in combat increased, so did recommendations to modify the Medical Department equipment in use. Field operations differed according to theater and to geographic location within a theater. Ingenuity showed itself early in that there was considerable improvisation of medical laboratory and other equipment used in the many field installations.

The Laboratories Division in the Surgeon General's Office received many suggestions and recommendations from laboratory officers in the Zone of Interior and the theaters of operations for modification of the medical laboratory chests, among other items. These communications were reviewed within the Preventive Medicine Service, and then with the Technical Division, after which they were sent to the Carlisle Barracks laboratory for evaluation.

Col. Earle D. Quinnell, MC, succeeded Colonel Dabney as director of the laboratory, and Maj. (later Lt. Col.) A. B. Christie, Jr., MC, was assigned as assistant director. As the volume of work under their direction increased and the urgent needs pertaining directly to patient care were given higher priorities, work on many types of field equipment had to be held in abeyance. At the same time, several uses were often found for an item which had been designed for one particular use; for example, the portable field autoclave, part of the equipment of the surgical truck, which lent itself well to many uses in both hospital and field medical laboratories (fig. 80).¹⁵²

Medical Nutrition Laboratory

The Medical Nutrition Laboratory¹⁵³ was authorized by Army Service Forces Circular No. 305, dated 14 September 1944, which stated, "the Nutrition Laboratory now located at the Army Medical Center, Washing-

¹⁵¹ Dabney, A. S.: The U.S. Army's Medical Department Equipment Laboratory; Its Research and Contributions to Field Service. Mil. Surgeon 91: 1-16, July 1942.

¹⁵² Annual Report, Medical Department Equipment Laboratory, 1943, Inclosure 6 thereto.

¹⁵³ Annual Report, Medical Nutrition Laboratory, 1944.



FIGURE 80.—Portable field autoclave, developed by the Medical Department Equipment Laboratory, shown installed in a surgical truck.

ton, D.C., is transferred to Chicago Quartermaster Depot. This activity is designated as the Medical Nutrition Laboratory, a class IV installation under the jurisdiction of the Surgeon General." The principal activities of the laboratory consisted of research on medical nutrition and instruction for nutrition officers and dietitians at the Depot and at Medical Department installations (fig. 81). Lectures on nutrition were included also in the tropical and military medicine course given at the Army Medical School.

Projects in the research program included study of the nutrient value of packaged rations, the use of vitamin supplements in media used for bacterial growth in preparing vaccines, and new methods for preparing dehydrated foods.

Capt. (later Maj.) George H. Berryman, SnC, commanded the Medical Nutrition Laboratory, and 1st Lt. (later Capt.) Cyrus E. French, SnC, was the executive officer and adjutant. The staff consisted of eight officers, seven enlisted men, and nine civilians. By virtue of its location in the Chicago Quartermaster Depot, the laboratory was in close and



FIGURE 81.—Dr. Esther DaCosta, at the Medical Nutrition Laboratory in Chicago, Ill., recording the weight of a rat fed an experimental diet.

convenient communication with quartermaster activities concerned with food procurement, packaging, and so forth. The laboratory was in constant communication also with the Nutrition Division of the Preventive Medicine Service, the Army Medical School, the Office of The Quartermaster General, and the Armored Medical Research Laboratory. Work was pursued on in-flight and between-flight menus for the Army Air Forces. The staff also devised an improved food package to be distributed to invalid American prisoners of war by the American Red Cross. A special recipe book was included in these packages to guide in the preparation of attractive meals from the staple items provided.

The laboratory compiled and revised information for several technical medical bulletins (TB Meds) and other publications concerning foods, nutrition, and diets. Advisers to the laboratory were Dr. Herbert Pollack and Dr. Paul E. Howe. Much of the laboratory's program was developed with the assistance of Col. John B. Youmans, MC, and Maj. (later Lt. Col.)

William F. Ashe, Jr., MC, of the Nutrition Division of the Preventive Medicine Service.¹⁵⁴

Medical Laboratory Activities at Quartermaster Corps Installations

Working closely with the Surgeon General's Office and the Medical Department at the war's beginning was the Resources Division of the Quartermaster Corps, directed by Lt. Col. (later Brig. Gen.) Georges F. Doriot, QMC. The Resources Division was concerned with problems of clothing and equipment development and production. Materials conservation and design was the responsibility of the Clothing and Equipage Branch of that division, which brought its staff into a joint development program with the Surgeon General's Office. In July 1942, this division became the Research and Development Branch of the new and larger Military Planning Division which later became the chief organization responsible for product development under Maj. Gen. (later Lt. Gen.) Edmund B. Gregory, The Quartermaster General during World War II.

The Climatic Research Laboratory at Lawrence, Mass., was another of many activities which brought together the research staffs of the Quartermaster Corps and the Medical Department. Lt. Col. (later Col.) John H. Talbott, MC, who had worked with the Harvard Fatigue Laboratory, became director of the laboratory which, in March 1943, undertook the important work on clothing requirements for cold climates. Later, a hot chamber was constructed to simulate desert and jungle conditions.¹⁵⁵ The work of this laboratory was coordinated with that of the Harvard University Fatigue Laboratory, which was under the directorship of Dr. David B. Dill. When Dr. Dill went on active duty, he was succeeded in 1941 by Dr. William Forbes as acting director. The Fatigue Laboratory was interested not only in the environmental effects on, but also the role of nutrition in, human efficiency. This latter interest related the Fatigue Laboratory closely to The Surgeon General's Medical Nutrition Laboratory and The Quartermaster General's Subsistence Research Laboratory which were housed in the Quartermaster General Depot at Chicago. Vital work on field rations was carried out in the Subsistence Research Laboratory. The presence of the Medical Nutrition Laboratory and the Subsistence Research Laboratory in this quartermaster installation in Chicago was of mutual benefit to their operations, and it also facilitated communication between The Quartermaster General and the Nutrition Division of the Preventive Medicine Service (p. 573).

¹⁵⁴ In accordance with par. III, Department of the Army General Orders No. 77, 15 Oct. 1953, the Medical Nutrition Laboratory was moved from the cramped quarters it occupied since 1944 at the Chicago Quartermaster Depot to greatly enlarged accommodations at the Fitzsimons Army Hospital in Denver. Since then, its functions have greatly expanded, and many valuable contributions have been made.

¹⁵⁵ Risch, Erna: *The Quartermaster Corps: Organization, Supply, and Services. Volume I. United States Army in World War II. The Technical Services.* Washington: U.S. Government Printing Office, 1953, pp. 76-77, and 81.

Medical Laboratory Activities at Chemical Corps Installations

In July 1943, a Medical Division was established in the Chemical Warfare Service at Edgewood Arsenal, Md., under Dr. Cornelius P. Rhoads of New York. He was commissioned as a colonel in the Medical Corps and served as chief of the division until April 1945. The division was responsible for conducting research connected with prevention and treatment of chemical warfare casualties, for carrying out toxicological studies related to hazards in the production of chemical warfare agents, and for liaison with The Surgeon General. By the end of 1943, new Chemical Warfare Service medical laboratories had been established at Camp Detrick, Md.; Dugway Proving Ground, Utah; and Camp Sibert, Ala. The Medical Division coordinated the work of all these laboratories and maintained liaison not only with the Surgeon General's Office but also with other War Department agencies and with the Canadian and British chemical warfare research offices.¹⁵⁶

In January 1944, the Chemical Warfare Service was charged additionally with responsibility for all biological warfare defense projects. This assignment originated in October 1941, when the Secretary of War requested the National Academy of Sciences to appoint a civilian committee to review the field of biological warfare. The response was the formation of the so-called WBC (War Bureau of Consultants) Committee which included representatives of the Surgeon General's Office as liaison members.

The WBC Committee recommended in June 1942 that a civilian agency be delegated the responsibility for supervising all aspects of biological warfare. Shortly thereafter, Mr. George W. Merck was named to head the War Research Service which was to supervise and coordinate biological warfare defense activities of the military services, Public Health Service, Department of Agriculture, Federal Bureau of Investigation, and the Office of Strategic Services.¹⁵⁷

Dr. Ira L. Baldwin, of the University of Wisconsin, was named to develop a research program on biological warfare defense. This program was launched in newly constructed facilities at Camp Detrick, in the spring of 1943. It was the first of four such installations, the others being in Pascagoula, Miss.; Tooele, Utah; and Terre Haute, Ind. When this facilities development program was completed, responsibility for the overall biological warfare defense effort was assigned to the Chemical Warfare Service. Mr. Merck was named as special consultant to the Secretary of War on biological warfare, and a U.S. Biological Warfare Committee was established to advise him and also to maintain liaison with Canadian and British representatives. The number of individuals associated with the

¹⁵⁶ Brophy, Leo P., and Fisher, George J. B.: *The Chemical Warfare Service: Organizing for War*. United States Army in World War II. The Technical Services. Washington: U.S. Government Printing Office, 1959, pp. 101-122.

¹⁵⁷ Merck, G. W.: *Biological Warfare; Report to the Secretary of War*. Mil. Surgeon 98: 237-242, March 1946.

biological warfare defense mission of the Special Projects Division, Chemical Warfare Service, was 3,900, most of whom were stationed at Camp Detrick. Nine Army officers, eight civilians, six Navy officers, and seven Navy enlisted men were assigned to the division headquarters office which was concerned primarily with the administration and supervision of contract research at universities and in industry.

The program at Camp Detrick developed rapidly with joint participation of the Chemical Warfare Service and the Medical Departments of the Army and the Navy. It included research and development on mechanical, chemical, and biological methods of defense against biological warfare as well as production of possible retaliatory agents. Medical and Sanitary Corps laboratory officers, used primarily as pathologists and chemists, were active in this program. Its growth was so rapid that even the best efforts at coordination could not avoid duplication of work in certain facets of this newly developed field. It was rapid enough also to compete for personnel with the Manhattan Project.¹⁵⁸

At Camp Detrick, classes were held during the early months of 1944 for senior and specially qualified Chemical Corps and Medical Corps officers and their naval counterparts. It was intended that these officers would be properly coached in anti-biological warfare procedures should the need for such arise in the theaters of operations. A total of 217 officers were graduated from this course.

In the background of biological warfare was a paper by Major Fox, who reviewed the matter in 1933,¹⁵⁹ and concluded that there were insurmountable technical obstacles to the use of biological agents as weapons. However, the then Major Simmons, on duty in Panama in 1934, was so impressed with the hazard of yellow fever and its possible intentional introduction that he prepared an informal plan to counteract such a move in the event of war. In 1939, the possibility of biological warfare was considered by Col. (later Brig. Gen.) Charles C. Hillman, MC, Lt. Col. (later Maj. Gen.) George S. Dunham, MC, and Colonel Kelser. Although there were doubts as to its feasibility, it was deemed prudent to consider means of counteracting a biological warfare attack directed against either personnel or animals. When the possibility of biological warfare was reviewed again in 1940, the consensus was that U.S. defenses against such an attack were inadequate. In January 1941, Colonel Simmons proposed that yellow fever vaccination be made mandatory for troops going to all tropical stations, since yellow fever might be used by the enemy for military purposes.

In August 1941, Colonel Simmons sent a memorandum to the Special Assistant to the Secretary of War, Mr. Harvey H. Bundy, stating that se-

¹⁵⁸ See footnote 156, p. 577.

¹⁵⁹ Fox, L. A.: *Bacterial Warfare: The Use of Biologic Agents in Warfare*. Mil. Surgeon 72: 189-207, March 1933. (Reprinted in Mil. Surgeon 90: 563-579, May 1942.)

rious consideration should be given to the advisability of developing facilities within the Medical Department for intensive research on methods for preventing diseases of man, lower animals, or plants that might be introduced artificially by military enemies. During the same month, Mr. Bundy called a conference to consider initial steps in the development of defensive aspects of biological warfare, with Colonel Simmons representing the Medical Department. At that time, it was agreed that a committee of civilian experts would be sought to review the biological warfare field. From that meeting came the Secretary of War's decision, on 1 October 1941, to request the National Academy of Sciences to appoint a civilian committee, which took the form of the WBC mentioned earlier.

The anti-biological warfare organization established in the Hawaiian Department in 1942 became an organization which functioned so well that Colonel Simmons commended it for working intelligently and effectively in preparing countermeasures against possible enemy attempts to wage biological warfare. The concern expressed about possible biological warfare attacks in the Hawaiian Islands represented the first War Department activity specifically organized to provide defense against such an attack, and this related not only to the possibility of yellow fever but also to the use of botulinus toxin in water supplies and the possible use of plague.

In reviewing the contributions of the Medical Department laboratory representatives to the research program under the War Research Service, special attention should be given to the work on X-toxoid, the toxoid protective against botulinus toxin type A. Work on the toxoid had been started by Dr. Mueller and then Captain Pappenheimer, under contract at Harvard Medical School. This work was later taken over by the Chemical Warfare Service, and the Harvard botulinus type A toxoid was used for immunizing laboratory workers at Camp Detrick. Active in this program were Colonel Robinson, of the Laboratories Division, Preventive Medicine Service, SGO, and Dr. N. Paul Hudson, the consultant on biological warfare to the Preventive Medicine Service.

Much information was obtained about the biological warfare program in Germany and in Japan through a team which included Army medical laboratory officers. A member of one of these teams was Maj. William J. Cromartie, MC, an Army pathologist. Other Medical Department laboratory officers contributed to the achievements of the division, which included fundamental observations on the growth of micro-organisms and their production in quantity, methods of detecting small numbers of micro-organisms, knowledge about the control of airborne diseases, methods of inducing immunity against certain infectious diseases, advances in the treatment of certain infectious diseases of man and animal, procurement of important information on the production and control of certain diseases

in plants, and the effect of chemical agents on the metabolism and growth of plants.¹⁶⁰

The Medical Department was active also in the defense aspects of chemical agents as weapons and participated in developing protective measures, methods of treating casualties, and in the training of officers in chemical warfare defense. Such work was concentrated at Edgewood Arsenal, Md. Contracts for procuring individual items and kits necessary for the treatment of gas casualties were negotiated through the Surgeon General's Office. In April 1945, Col. John R. Wood, MC, became director of the Medical Research Laboratory at Edgewood Arsenal, and subsequently succeeded Colonel Rhoads as Chief of the Medical Division, Army Chemical Corps. Following this important assignment, Colonel Wood became Chairman, Medical Research and Development Board, SGO, and later became director of the Walter Reed Army Institute of Research, Washington, D.C.

Malaria Control and Survey Units

Many tributes have been paid to the malaria control and survey units and to the laboratory officers who served with them. Although these units were active in all overseas theaters, the Pacific theaters required the largest number. For example, in April 1945, when control units numbered 143 and survey units 63, there were 85 control units serving in the Southwest Pacific and Pacific Ocean Areas and 52 survey units active in these theaters.¹⁶¹ The tribute paid to these units in December 1944, by General Denit, Chief Surgeon, Southwest Pacific Area, is cited by Dr. Paul F. Russell and reads in part:¹⁶²

The reduction of the malaria attack rate in this theater to a point at which it no longer constitutes a dangerous handicap to our military effort is an achievement of historical importance in preventive medicine. * * * In this accomplishment the malariologists and the malaria survey and malaria control units have played the major role. Despite hardships and often danger, their achievements have been notable.

At the war's beginning, the number of officers and enlisted men who had any familiarity with malaria was so small that an extensive training program was necessary. The selection and training of personnel was a responsibility shared by the Tropical Disease Control, Laboratories, and Sanitary Engineering Divisions of the Preventive Medicine Service, and the Training Division of the Surgeon General's Office. Medical Corps officers selected for training in malaria work were usually those who had completed the 8-week course in tropical medicine conducted at the Army

¹⁶⁰ Cromartie, W. J., Bloom, W. L., and Watson, D. W.: Studies on Infection with *Bacillus anthracis*; Histopathological Study of Skin Lesions Produced by *B. anthracis* in Susceptible and Resistant Animal Species. *J. Infect. Dis.* 80: 1-13, January-February 1947.

¹⁶¹ See footnote 59 (2), p. 488.

¹⁶² Russell, Paul F.: Introduction. In *Medical United States Army. Preventive Medicine in World War II. Volume VI. Communicable Diseases: Malaria*. Washington: U.S. Government Printing Office, 1963, ch. I.

Medical School. There had to be extensive recruitment of entomologists and parasitologists for the malaria survey units, and these came from educational institutions, the U.S. Department of Agriculture, and the U.S. Public Health Service.

As the demand for malaria control units grew, candidates for assignment to these units had to be selected from among students graduating from the Army Specialized Training Program. They were commissioned in the Sanitary Corps, given field and laboratory training, and then assigned to such control units. The Tennessee Valley Authority also conducted training courses in malaria control at its Wilson Dam, Ala., installation. However, this was not sufficient to train the numbers of officers needed, and so additional training facilities had to be established in Florida through the cooperation of its board of health. An important addition to the training facilities was established in September 1943, with the authorization for the Army School of Malariology in the Canal Zone. Training of malaria survey and control units was continued throughout the war at the Unit Training Center at Camp Plauche, La. This location made it possible to give courses in the form of 4-week training programs throughout the year. (See ch. I, pp. 19–20.) Key personnel of the other Preventive Medicine Service divisions, with whom the Laboratories Division worked on the staffing of these units, were Col. William A. Hardenbergh, SnC, director of the Sanitary Engineering Division, and Maj. (later Lt. Col.) Oliver R. McCoy, MC, director of the Tropical Disease Control Division.

Some difficulty was experienced in obtaining authorization to activate these malaria units for training well before their commitment to overseas stations. Indicative of the output of the extensive training programs described above are the numbers of survey and control units in various stages of organization and activation as early as February 1944. There were 35 survey units and 65 control units in overseas theaters at that time. In addition, seven survey and eight control units were en route to overseas assignments, and 17 survey and 37 control units were activated and scheduled for such assignments, making a total of 59 survey and 110 control units as of February 1944.¹⁶³

The Medical and Sanitary Corps laboratory officers assigned to the survey and control units had been trained at one of the facilities described above. The breadth of their competence was such that, when circumstances demanded, these officers were occasionally assigned to scrub typhus, encephalitis, venereal disease, filariasis, dengue, and schistosomiasis control activities. The enlisted men assigned to the malaria units were usually of high caliber but often untrained for their assignments. However, under the guidance of officers in these units, they soon became competent technicians. In an account of malaria control in the South Pacific, it was rec-

¹⁶³ See footnote 59 (2), p. 488.



FIGURE 82.—Malaria mosquito identification on Okinawa. Maj. Wilbur G. Downs, MC (at microscope), assisted by CPhM Robert L. Ingram, working with Naval Medical Research Unit No. 2, assigned to the Tenth U.S. Army.

commended that enlisted men assigned to malaria units have formal training in the varieties of work expected of them (fig. 82).¹⁶⁴

Medical Laboratory Support for Transportation Corps Operations

The evacuation, by train and ship, of American sick and wounded overseas was handled jointly by the Medical Department and the Transportation Corps, with the Medical Department providing personnel, hospital supplies, and equipment.¹⁶⁵

The first three ships to serve were the USAHS *Acadia*, the USAHS *Seminole*, and the USAHS *Shamrock*, all having been designated as hospital ships in the summer of 1943.¹⁶⁶ By mid-1945, there were 29 Army

¹⁶⁴ Harper, Paul A., Downs, Wilbur G., Oman, Paul W., and Levine, Norman D.: New Hebrides, Solomon Islands, Saint Matthias Group, and Ryukyu Islands. In *Medical Department, United States Army. Preventive Medicine in World War II. Volume VI. Communicable Diseases: Malaria*. Washington: U.S. Government Printing Office, 1963, ch. VIII.

¹⁶⁵ Smith, Clarence M.: The Medical Department: Hospitalization and Evacuation, Zone of Interior. United States Army in World War II. The Technical Services. Washington: U.S. Government Printing Office, 1956, pp. 349-357, 394-425.

¹⁶⁶ Bykofsky, Joseph, and Larson, Harold: The Transportation Corps: Operations Overseas. United States Army in World War II. The Technical Services. Washington: U.S. Government Printing Office, 1957, p. 179.

hospital ships. The personnel debarkation points were often pressed to provide support upon the arrival of patients, especially those from the Pacific Ocean Areas for whom there was particular concern because of their exposure to parasitic diseases.

As the evacuation of troops and patients expanded, it was clear that closer liaison was needed between the Surgeon General's Office and the Chief of Transportation. The Surgeon General designated as medical regulating officer, Col. John C. Fitzpatrick, MC, who had served first as a medical liaison officer and then as medical regulating officer. At the peak of activity of this office, Colonel Fitzpatrick had a staff of six officers and 21 civilians.

The work of a hospital ship laboratory is well described in the history, dated 30 October 1945, of the 215th Hospital Ship Complement which staffed the USAHS *Hope*. The 215th Hospital Ship Complement was organized at Camp Stoneman, Calif., in February 1944, and the *Hope* sailed from Camp Anza on 23 September, under the command of Lt. Col. (later Col.) Thomas B. Protzman, MC. The *Hope* served in the Pacific for 14 months on its first tour and evacuated more than 9,000 patients. The bed capacity was 705, and the laboratory was authorized to perform the tests for which a 750-bed hospital was equipped, according to TB Med 135. Before this tour ended, the laboratory staff felt that it was capable of meeting the requirements of a 1,000-bed hospital. More than 22,000 examinations were performed. The laboratory was prepared to carry out more than a hundred different tests, including blood chemistry. Autopsies were performed, photographs were taken of lesions, and the fixed specimens were referred to a hospital or a medical laboratory at the next port of call. The blood bank was active, and, to supplement the whole blood carried for each mission, more than 500 units were donated by members of the ship's complement.

The larger troop transports had facilities for performing the simpler clinical laboratory procedures, and when there was no medical officer assigned to troop units traveling on these ships, the tests were performed by the medical officers assigned to the ship's complement. The transport surgeon, a member of the permanent military complement, was responsible to the transport commander. He was to give attention to all matters affecting the health of troops while on shipboard, including sanitation, ventilation, the investigation of any illness which might develop during the voyage, and performance of any laboratory tests required for such investigation. However, small transports, such as the *Liberty* and *Victory* ships, often did not have medical officers in the ship's complement. Medical officers assigned to troop units being shipped were then pressed into such service by transport commanders. When there were no medical officers on board, those requiring medical care were either transferred at sea to the nearest ship having a medical officer on board, or a medical officer was brought to the ship whose patients required the medical aid.

GOVERNMENTAL AND OTHER SUPPORTING AGENCIES AND INSTITUTIONS

U.S. Public Health Service

In September 1940, the full-time staff of the U.S. Public Health Service, serving under Surgeon General Thomas Parran, totaled 8,700. This staff had already been extending its assistance to the Army's preventive medicine program during the limited national emergency. This assistance took the form of developing and producing, in unprecedented volumes, vaccines and other biologicals for prophylactic and diagnostic use.

The impressive achievements of the Public Health Service and its contributions in World War II are recorded well in a book by Dr. Ralph C. Williams. The book describes in detail the research work on the recognition and control of the important infectious diseases, the role of the quarantine service, and the marine hospitals.¹⁶⁷

Collaboration between the Army and the U.S. Public Health Service began early in the mobilization period. It was clear that the Army would need assistance from the Public Health Service through joint measures which would maintain high levels of environmental sanitation in the vicinity of the rapidly growing centers of troop concentration in the southern United States. The aid of the Public Health Service was to be sought and welcomed also in the field of venereal disease control. Early in January 1940, the Army Surgeon General approached The Adjutant General on the advisability of soliciting assistance from the Public Health Service. This suggestion took the form of a request from the Secretary of War to Mr. Paul V. McNutt, Federal Security Administrator, in a letter dated 30 January 1940. The response was prompt and wholehearted. Mr. McNutt stated that cooperation and assistance would be "extended gladly."¹⁶⁸ This correspondence initiated a series of conferences which lead to the formulation of plans for the Public Health Service to accept responsibility for extracantonment sanitation at Army posts throughout the country. By mutual agreement, the Public Health Service was to assign one of its officers to each corps area headquarters. This launched a broad program of assistance which the Public Health Service extended to the Army and one which reached ultimately into all of the overseas theaters.

In 1940, the Regular Corps of the Public Health Service consisted of approximately 400 officers, of whom only about 100 had experience in public health administration. Despite this relative shortage to meet re-

¹⁶⁷ Williams, Ralph C.: *The United States Public Health Service, 1798-1950*. Bethesda: Commissioned Officers Association of the United States Public Health Service, 1951, pp. 612-768.

¹⁶⁸ Sternberg, Thomas H., Howard, Ernest B., Dewey, Leonard A., and Padget, Paul: *Venereal Diseases. In Medical Department, United States Army. Preventive Medicine in World War II. Volume V. Communicable Diseases Transmitted Through Contact or By Unknown Means*. Washington: U.S. Government Printing Office, 1960, ch. X.

sponsibilities that were to grow progressively, assignments were made to the Army in the Zone of Interior and to overseas activities where the hazards of diseases little known in this country were becoming problems. Among these were scrub typhus and epidemic typhus. The support given in this field through the U.S.A. Typhus Commission has already been mentioned. Difficulties with diarrheal diseases were anticipated, and diagnostic and control studies were undertaken by Dr. Albert V. Hardy and Dr. James Watt in the southern States and in Puerto Rico. A major contribution came in the field of venereal disease control, for which the Public Health Service already had a growing program. In malaria control, the Public Health Service had also had valuable experience, and this was shared with the military forces. The effective organization known as MCWA (Malaria Control in War Areas) and its laboratories was to be the forerunner of the Communicable Disease Center in Atlanta, Ga. The assistance received from the Public Health Service in controlling malaria in Puerto Rico is an excellent example. Among Army personnel in Puerto Rico, case rates ran as high as 320 per 1,000 per month in the fall of 1941. Through efforts which involved the Army, Navy, Public Health Service, and the Insular Health Department, the case rate in 1945 had fallen to 6 per 1,000 per month.¹⁶⁹

Among those serving with the Army in the China-Burma-India Theater early in the war was Dr. Victor Haas, who worked with the Army headquarters at Ledo, Assam, as preparations were being made for the operation which was to recapture Burma. Other Public Health Service officers were active during the Philippine campaign, including Dr. Wright, Dr. Floyd A. Hawk, and Dr. James G. Telfer. Dr. Wright's work, as a member of the Army Epidemiological Board's Commission on Schistosomiasis, has been mentioned earlier. On duty in North Africa were Dr. Dorland J. Davis and Dr. Michael L. Furcolow, who were concerned with the control of malaria, epidemic typhus, and yellow fever. Active with the Army in the Mediterranean and European theaters were Dr. Leonard A. Scheele and Dr. Joseph A. Bell. Dr. Bell, as Major Bell, was later to participate also in the activities of the Typhus Commission. Another Public Health Service officer to become active in typhus research, and who was to serve in China with the Typhus Commission, was Lt. Col. Alexander G. Gilliam.¹⁷⁰

The U.S. Public Health Service can take exceptional pride in the contributions of these career scientists who, as medical officers, worked with the military services and shared their many burdens. The generous support given to the Army's medical laboratories by the Public Health Service through its assistance to State and other health department laboratories is presented in the following section.

¹⁶⁹ See footnote 167, p. 584.

¹⁷⁰ See footnotes 145, p. 568, and 167, p. 584.

State and Other Health Department Laboratories

In an assessment of the contributions made by State and other health departments and their laboratories, it is plain that whatever was done for the Army's medical laboratories was done at great sacrifice. For example, in June 1941, there were 500 vacancies in key positions in State and local health departments.¹⁷¹ Furthermore, it was unclear at that time what the status would be of those laboratory specialists who occupied important positions in health departments, should there be a general mobilization. Surgeon General Parran of the U.S. Public Health Service sought to determine this from Surgeon General Magee and inquired also about the induction status of those staff members who held Reserve commissions in health departments. Surgeon General Parran had requested that Reserve officers who held full-time positions of strategic importance in State and local health departments be placed on a deferred list. When projecting needs for preventive medicine officers in October 1940, Surgeon General Magee stated that there would be no further calls of Reserve officers serving in State and local health departments until July 1941 or later. It was understood between Surgeon General Parran and Surgeon General Magee that individual cases of hardship would be brought to the attention of Surgeon General Magee.

However, the demand for laboratory officers was great, and the staffs of State and other health agencies were soon severely reduced, not only because of the military needs, but also because of the higher wages offered by private industry and Federal agencies, which removed many workers from State and local health departments, hospitals, and laboratories. Shortages of personnel in the health field were crucial in 1944, despite the great effort made by the Public Health Service to bolster State and local health department staffs. Deficient health services in many of the communities which surrounded major Army, Navy, and industrial establishments were related in part to inadequate State expenditures for public health workers' salaries. Only 13 percent of the critical war production areas in the country were budgeting the minimum amount per capita for public health work. This had been set at \$1 per capita, and many areas were spending less than 10 cents per capita per year for such work. These factors, among others, led to a reduction in full-time local health officers of 13 percent between 1941 and 1945.¹⁷²

The foregoing emphasizes the sacrifices made by those State and city health department laboratories which were called upon to assist the induction stations in their massive programs of serologic testing for syphilis. Each registrant under the Selective Training and Service Act was to have a routine test for syphilis performed at the time of registration. This recommendation emerged from the conference of State health officers

¹⁷¹ See footnote 167, p. 584.

¹⁷² See footnote 167, p. 584.

convened, on 16 September 1940, by Surgeon General Parran and was accepted by the War and the Navy Departments.¹⁷³ Although the burden on these laboratories was great, their work provided vital information for the War and the Navy Departments and became the basis for the largest syphilis case-finding program ever undertaken.

Also important to the War and the Navy Departments was the work done by the State and local health department laboratories in the field of water and milk sanitation.

The Wassermann Laboratory of the Antitoxin and Vaccine Laboratory, Massachusetts Department of Public Health, illustrates these points well. In the fiscal year 1940 report of the Wassermann Laboratory, dated 10 December 1940, Dr. William A. Hinton, chief of the laboratory, mentioned that preparations were being made to accept a large number of specimens from the Selective Service Boards and the National Guard. Serologic tests for syphilis performed for these military groups were concentrated in the latter part of fiscal year 1940, when 1,825 were performed for the Selective Service Boards and 2,143 for the National Guard. In the annual report for the following year, Dr. Hinton stated that 68,363 serologic tests for syphilis were performed for the Selective Service Boards, and 8,484 for the National Guard.

In the fiscal year 1941 preliminary report of the Division of Biologic Laboratories, Massachusetts Department of Public Health, dated 11 December 1941, Dr. Elliott S. A. Robinson, the director, described the assistance given to activities supporting the national defense efforts, among them being the preparation of serum albumin as a plasma substitute. In the division's annual report for fiscal year 1942, dated 10 December 1942, Dr. Geoffrey Edsall, then acting director, noted that Dr. Robinson had departed for Army duty with assignment to the Preventive Medicine Division of the Surgeon General's Office. Accompanying him to the Surgeon General's Office was the assistant director, Col. Arthur P. Long. Dr. Edsall mentioned in the same report that the laboratory had lost half of its staff to the military services at a time when the volume of work in the Wassermann Laboratory had almost doubled. In addition to the serologic tests for syphilis, other tests were performed on Red Cross blood specimens which were being used for plasma and albumin production.

The demands of the Army grew rapidly, and as they did, preparation was made to expand the work of the Army laboratories, particularly the service command laboratories. The rapid expansion of the services of these laboratories ultimately relieved the State and local health department laboratories of the work which they had done so well and in such large volume during the limited national emergency and in the early phase of the war. As is plain from the reports mentioned in the section on the service command laboratories, the largest volume of laboratory

¹⁷³ See footnote 167, p. 584.

work was related to serologic tests for syphilis, and to water and milk bacteriology.

Field maneuvers were a test of, and a challenge to, many of the State and local health department laboratories, particularly during the limited national emergency. As in other operations conducted in support of the Army, the Public Health Service assisted the State health departments in checking on water, milk, and field sanitation in war maneuver areas. In July 1940, a jointly staffed laboratory of this type was set up in a high school in Little Falls, Minn., adjacent to the Camp Ripley war maneuver area. Mr. Herbert M. Bosch, the State's public health engineer was in charge of the laboratory which served throughout the maneuver period.¹⁷⁴

An unusual opportunity for training Sanitary Corps laboratory officers appeared in May 1945, when the Health Department of Birmingham, Ala., undertook a citywide program for serological testing and treatment of syphilis. The U.S. Public Health Service, which supported and directed the study, was faced with the processing of more than 300,000 serologic specimens in a 6-week period. Responsibility for providing a staff and facilities for the study was shared by Birmingham and the Public Health Service. The Laboratories Division promptly accepted an invitation to assign laboratory officers to the study, because the experience in handling large numbers of specimens would be valuable to Sanitary Corps laboratory officers, should they be assigned to laboratories serving separation centers. Nine recently commissioned Sanitary Corps laboratory officers were assigned by the Laboratories Division to the Birmingham study.¹⁷⁵

U.S. Department of Agriculture

Many segments of the Army's preventive medicine program were accelerated by the superb laboratory and field research of the Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture. A stimulus to early work by the bureau was the need to control malaria in the Southern United States where most U.S. troops were stationed. This had been undertaken by the Army with the strong support of the U.S. Public Health Service. In the Preventive Medicine Service, the control of mosquitoes in and near Army establishments was an activity delegated to the Sanitary Engineering Division. The division's director was Colonel Hardenbergh, an outstanding figure and vigorous leader in this field which was to grow so rapidly in its importance to the Army. It was he who maintained the alert which carried developments at the Orlando and Beltsville laboratories of the Bureau of Entomology to their earliest possible

¹⁷⁴ (1) Letter, R. A. Vonderlehr, Asst. Surgeon General, Division of Venereal Diseases, U.S. Public Health Service, to Col. Albert G. Love, MC, Office of The Surgeon General, 27 July 1940. (2) Mr. Bosch later served with the Sanitary Corps and became a member of the Commission on Environmental Hygiene, Armed Forces Epidemiological Board.

¹⁷⁵ See footnote 17, p. 430.

application by the Army.¹⁷⁶ Directing the program of the Bureau of Entomology was Dr. E. F. Knippling, who recognized the importance of accelerating research on the chemical approach to the control of insect vectors of malaria, typhus, and other diseases of military importance. At the Orlando laboratory, the field use of DDT by the military was demonstrated to be a feasible procedure. This included the control of the mosquito and the louse as vectors of malaria and epidemic typhus, respectively.¹⁷⁷ The Orlando laboratory also led in the development of repellents. Emerging as the most effective of thousands of repellents tested was dimethylphthalate which was developed early enough in the war to be of considerable help in controlling scrub typhus in the China-Burma-India Theater and in the Southwest Pacific.

Early in 1942, arrangements between the Preventive Medicine Division, SGO, and the Bureau of Entomology were consummated for testing, at the bureau's Beltsville Research Center, Beltsville, Md., methyl bromide as an agent for the delousing of clothing and equipment. Even the initial tests showed the great efficacy of methyl bromide as a delousing fumigant, with both insects and ova being destroyed rapidly. By July 1942, the methyl bromide procedure was approved and adopted by the Services of Supply.¹⁷⁸

Medical and Sanitary Corps laboratory officers were among many others participating in the laboratory and field work relating to the development, and particularly the application, of these important chemical agents.

International Health Division of the Rockefeller Foundation

For many years before World War II, the International Health Division of the Rockefeller Foundation had been actively working on yellow fever, typhus, malaria, hookworm disease, rabies, and yaws, among other important infectious diseases. During World War II, however, the assistance given to the Army and its medical laboratories by the Rockefeller Foundation was concentrated in yellow fever, typhus, and malaria.

The seed virus for the yellow fever vaccine was the 17D strain derived originally from the Asibi strain. To stabilize the virus in the vaccine, human serum was used. As the demand for the vaccine grew rapidly and progressively, a variety of sources of human serum for the vaccine had to be utilized. The first indication that jaundice in epidemic form might be

¹⁷⁶ (1) Hardenbergh, William A.: Control of Insects. In Medical Department, United States Army. Preventive Medicine in World War II. Volume II. Environmental Hygiene. Washington: U.S. Government Printing Office, 1955, ch. V. (2) Hardenbergh, William A.: Research Background of Insect and Rodent Control. In Medical Department, United States Army. Preventive Medicine in World War II. Volume II. Environmental Hygiene. Washington: U.S. Government Printing Office, 1955, ch. VII.

¹⁷⁷ Knippling, E. F.: DDT for the Control of Lice and Fleas Attacking Man. In Rickettsial Disease of Man. Washington: American Association for the Advancement of Science, 1948.

¹⁷⁸ Reports of the Subdivision on Sanitation and Laboratories, Preventive Medicine Division, Office of The Surgeon General, 1 April-18 July 1942.

related to the yellow fever vaccine appeared in March 1942, approximately 1 month after the first cases of jaundice occurred in unusual numbers among troops.¹⁷⁹ Jaundice outbreaks were found to be related to particular lots of the vaccine. To investigate this further, the Preventive Medicine Service called upon the Army Epidemiological Board and its commissions.¹⁸⁰ Once the relationship to particular vaccine lots was established, a new vaccine, prepared without human serum, was produced by the U.S. Public Health Service at its Rocky Mountain Laboratory in Hamilton, Montana. No cases of jaundice followed the use of the new vaccine. Laboratory officers played an important role in both epidemiological and pathological studies of serum hepatitis.¹⁸¹

In the field of typhus control, the International Health Division of the Rockefeller Foundation worked with the U.S. Department of Agriculture, the National Institute of Health, the U.S. Public Health Service, and the Food and Drug Administration in aiding the Preventive Medicine Division's attack on the transmitter of epidemic typhus; namely, the body louse. The laboratories of the International Health Division provided training in typhus research for foreign nationals. The division assisted in the work of the U.S.A. Typhus Commission by assigning staff members to overseas units, such as the Forward Echelon which was established in Cairo, in January 1943. Working with the unit established in Cairo by the Typhus Commission were Dr. Fred L. Soper, Col. John Snyder, and Dr. Charles M. Wheeler, an entomologist working with the International Health Division, who was later commissioned as a major in the Sanitary Corps.¹⁸²

In malaria control, the assistance which the International Health Division gave to the Allied Forces during the war was partly an extension of the division's prewar malaria control activities, especially in the Caribbean area. These early studies were of great value to the Army during the limited national emergency and the initial phase of World War II. Beginning in 1920, the International Health Division had conducted malaria surveys and advised on malaria control in those parts of the Caribbean which were later to become key military bases. These included Panama, Puerto Rico, Cuba, British Guiana, and Trinidad.¹⁸³

During 1944 and 1945, Dr. Soper and other International Health Division staff members who were experienced in malaria control served with the Allied Commission which was responsible for malaria control first in the North African, and later in the Mediterranean theaters. Particular credit for the eradication of *Anopheles gambiae* from Egypt goes

¹⁷⁹ Strode, George K. (editor): *Yellow Fever*. New York: McGraw-Hill Book Company, Inc., 1951, pp. 36-37, and 423-424.

¹⁸⁰ Sawyer, W. A., et al.: Jaundice in Army Personnel in the Western Region of the United States and Its Relation to Vaccination Against Yellow Fever. *Am. J. Hyg.* 39: 337-430, May 1944; and *Am. J. Hyg.* 40: 35-107, July 1944.

¹⁸¹ (1) Freeman, G.: Epidemiology and Incubation Period of Jaundice Following Yellow Fever Vaccination. *Am. J. Trop. Med.* 26: 15-32, January 1946. (2) See footnotes 34 and 35, p. 455.

¹⁸² See footnote 145, p. 568.

¹⁸³ Annual reports of the Rockefeller Foundation, 1920-48.

to the Rockefeller Foundation and to those members of the International Health Division who worked with the Egyptian Government and Allied military representatives on this program, which began in 1943 and was concluded successfully in 1945.¹⁸⁴

Rockefeller Institute for Medical Research

As in World War I, the Rockefeller Institute for Medical Research contributed generously to the preventive medicine, medical laboratory, and research programs of the Army and the Navy. Much of the assistance to the Army came through the efforts of staff members who worked with the various commissions under the Army Epidemiological Board as Medical and Sanitary Corps laboratory officers and epidemiologists. Among those who were commissioned in the Army were Frederik B. Bang, William Trager, Malcolm S. Ferguson, R. Walter Schlesinger, and William G. Jahnes. Most of their efforts were concentrated either in the Pacific or on problems which the Army encountered in the Pacific. In his recent [1964] book, Dr. George W. Corner details, with praise, the work of those staff members who served as commissioned officers in the Army, those who continued their research at the Rockefeller Institute for Medical Research in New York and in its Department of Animal and Plant Pathology in Princeton, N.J., and those who joined the Naval Research Unit at the Hospital of the Rockefeller Institute.¹⁸⁵

In 1943, Lieutenant Bang and Lieutenant Trager studied malaria and its field control and therapy in New Guinea and Australia. Capt. (later Maj.) Malcolm S. Ferguson, SnC, was with Army units which landed early on Leyte in October 1944. There he undertook a survey for schistosomiasis. At the 118th General Hospital, the Johns Hopkins Hospital unit on Leyte, Captain Ferguson established a schistosomiasis research unit. Captain Bang joined the unit soon after its formation. This activity represented the beginning of an extensive program on the epidemiology of schistosomiasis as it was to be developed by the Army and by members of the Army Epidemiological Board's Commission on Tropical Diseases.¹⁸⁶

In 1944, at the Princeton branch of the Rockefeller Institute, Colonel Sabin set up a laboratory for research on dengue, and at the New Jersey State Prison, at Trenton, he organized a hospital unit for the study of volunteers to be infected with the agents which were being isolated from cases of dengue in the Pacific. Assisting in the work of the Princeton

¹⁸⁴ Rehn, John W. H.: Africa-Middle East Theater. In Medical Department, United States Army. Preventive Medicine in World War II. Volume VI. Communicable Diseases: Malaria. Washington: U.S. Government Printing Office, 1963, ch. VI.

¹⁸⁵ Corner, George W.: A History of the Rockefeller Institute, 1901-1953, Origins and Growth. New York: Rockefeller Institute Press, 1964, pp. 519, 525, and 527, and 529-531.

¹⁸⁶ Ferguson, Malcolm S., and Bang, Frederik B.: Schistosomiasis. In Medical Department, United States Army. Volume V. Communicable Diseases Transmitted Through Contact or By Unknown Means. Washington: U.S. Government Printing Office, 1960, ch. VI.

laboratories were 1st Lt. (later Capt.) William G. Jahnes, SnC, and 1st Lt. (later Capt.) R. Walter Schlesinger, MC.¹⁸⁷

Encephalitis research was a major activity at the Rockefeller Institute for many years before the war. Staff members engaged in this research who became consultants to the Army Epidemiological Board's Commission on Neurotropic Virus Diseases were Drs. Leslie T. Webster, P. K. Olitsky, and Jordi Casals.¹⁸⁸ Colonel Sabin, a former member of the Rockefeller staff, worked with the Commission on Neurotropic Virus Diseases and the Rockefeller staff, establishing a laboratory at the Princeton branch of the Rockefeller Institute for the development of the Japanese B encephalitis vaccine. In addition, he conducted epidemiological studies in the Pacific, particularly in Korea, the Philippines, and on Okinawa, and carried out early trials with the newly developed Japanese B encephalitis virus vaccine.¹⁸⁹

At the Rockefeller Institute, Dr. Herbert S. Gasser, who was then director of the Institute, was chairman of an Office of Scientific Research and Development subsection on the toxicity of mustard gases. He studied the use of bacteria and protozoa as possible tools for detecting mustard gases. In 1943, Dr. Donald D. Van Slyke and his group developed the copper sulfate method for determining the specific gravity of blood and plasma. Shortly after its introduction, this method was widely adopted by the military for evaluating hemoconcentration in shock.¹⁹⁰

In the Princeton laboratories, under the direction of Dr. Carl TenBroeck, attempts were made to produce hepatitis in swine and horses with yellow fever vaccine lots which had been suspected of being icterogenic. Similar attempts were made with material obtained from human cases of jaundice which followed the administration of the yellow fever vaccine.

Dr. TenBroeck and his associates, Dr. John Nelson and 1st Lt. (later Capt.) Edwin P. Albright, MC, studied dysentery in Army camps in the Southern United States. In the Princeton laboratories, shigellas isolated during outbreaks of bacillary dysentery were characterized and classified. In addition, TenBroeck, Nelson, and Albright studied shigella carriers among German prisoners of war who had served with Rommel's *Afrika Korps*. It was observed in these field studies that mass treatment with sulfadiazine reduced the shigella carrier rates promptly.

¹⁸⁷ Sabin, Albert B.: Dengue. In Medical Department, United States Army. Preventive Medicine in World War II. Volume VII. Communicable Diseases: Arthropodborne Diseases Other Than Malaria. Washington: U.S. Government Printing Office, 1964, ch. IV.

¹⁸⁸ See footnote 185, p. 591.

¹⁸⁹ (1) Sabin, Albert B.: Encephalitis. In Medical Department, United States Army. Preventive Medicine in World War II. Volume VII. Communicable Diseases: Arthropodborne Diseases Other Than Malaria. Washington: U.S. Government Printing Office, 1964, ch. II. (2) Sabin, A. B.: Epidemic Encephalitis in Military Personnel; Isolation of Japanese B Virus on Okinawa in 1945, Serologic Diagnosis, Clinical Manifestations, Epidemiologic Aspects, and Use of Mouse Brain Vaccine. J.A.M.A. 133: 281-293, 1 Feb. 1947.

¹⁹⁰ Phillips, R. A., Van Slyke, D. D., Dole, V. P., Emerson, K., Hamilton, P. B., and Archibald, R. M.: The Copper Sulfate Method For Measuring Specific Gravities of Whole Blood and Plasma. Bull. U.S. Army M. Dept. 71: 66-83, December 1943.

Dr. TenBroeck was a member of the Commission on Tropical Diseases of the Army Epidemiological Board, and when the board formed its Subcommittee on Dysentery early in 1944, Dr. TenBroeck became its director. This unit was formed to investigate diarrheal disease in Army units stationed in India. The other members of the subcommittee were Dr. Nelson, a member of the Rockefeller Institute staff, and Major Dammin, who served as parasitologist and executive officer. For this mission, lyophilized shigella typing sera and other diagnostic reagents were prepared at the institute.¹⁹¹

The early phase of the study was carried out from May to September 1944, at the 112th Station Hospital in Calcutta, where the investigation concentrated on the dispensary and hospitalized patients with acute diarrheal disease. It was observed that one-fourth of the patients who required admission to the hospital had shigella dysentery and one-fourth, amebic dysentery. No causal agent could be isolated from the remainder. In the last-mentioned, the nonspecific group, acute diarrheal disease accounted for most of the dispensary admissions.

The later phase was carried out at the 20th General Hospital, located on the Ledo Road in Assam. Hospitalized patients were studied, but the investigation focused on diarrheal diseases occurring in independent Army engineer, and other, units stationed in the Ledo area and in Myitkyina, Burma. Most acute diarrheal disease was identified as bacillary dysentery due to shigellas.¹⁹² Fecal specimens from cases of nonspecific diarrhea were introduced into monkeys, but no disease resulted (fig. 83).

The observations that *Shigella shiga* infections were no more severe than those caused by other shigellas, and that *Shigella ambigua* (Schmitz) infections could be as severe as any, both ran counter to the usually held beliefs. Mass treatment with sulfadiazine, as employed in Dr. TenBroeck's previous studies, was applied to field units having a high carrier rate for shigellas and which were experiencing diarrheal disease. This treatment led to prompt and marked reduction of the carrier rate and the diarrheal disease.¹⁹³

Dr. Thomas M. Rivers, director of the Hospital of the Rockefeller Institute, organized the Naval Research Unit at that hospital. This unit began its service for the Navy by receiving those patients from the U.S. Naval Hospital in Brooklyn who were suffering from diseases of particular military interest and in which the staff had developed a research experience. Naval personnel were admitted as patients of the new unit as early as January 1942.

¹⁹¹ See footnote 185, p. 591.

¹⁹² Nelson, J. B., TenBroeck, C., and Dammin, G. J.: Distribution of *Shigella* in India as Determined by Spot Agglutination With Absorbed Sera. *Am. J. Pub. Health* 35: 1282-1286, December 1945.

¹⁹³ Report, Maj. Gustave J. Dammin, MC, Executive Officer, Subcommittee on Dysentery, Commission on Tropical Diseases, Army Epidemiological Board, to The Surgeon General, U.S. Army, 15 Dec. 1944, subject: Diarrheas and Dysenteries in the India-Burma Theater.



FIGURE 83.—The Subcommission on Dysentery of the Army Epidemiological Board in the India-Burma Theater. A. Laboratory of the subcommission, shown on the post occupied by the 20th General Hospital in Assam. B. Pvt. F. A. Ziegler and T/4 W. S. Bose examining a monkey, to determine presence of filtrable enteropathogens in fecal specimens from cases of acute diarrhea. C. Dr. Gordon Seagrave's hospital laboratory, in Myitkyina, as it appeared in October 1944.

As the Navy saw the need for a research hospital in the Pacific, the unit, redesignated as NAMRU-2 (U.S. Naval Medical Research Unit No. 2), was commissioned at the institute in June 1944. Under the command of Capt. (later Rear Adm.) Thomas M. Rivers, MC, USNR, the unit departed in December 1944, and arrived at Guam on 12 January 1945. Medical Research Unit No. 2 carried out an active program at its base and sent teams to the forward areas, where it worked with Army units. Among the more exciting details drawn by NAMRU-2 staffs members was the one which took Comdr. Richard E. Shope, MC, USN, and a small group to Okinawa (fig. 84). Commander Shope and his group landed with the assault party on Okinawa on 13 April 1945. Working with the Tenth U.S. Army, and under constant fire from the enemy, this group set out to determine whether Okinawa would present an invasion force with any unusual health hazards. Surveys were made for malaria, schistosomiasis, and diarrheal disease, but these and other surveys showed that the native population would present the Army with no health hazards with which they were not already familiar. Commander Shope and his group, after serving with the Tenth U.S. Army, returned to Guam as soon as the occupation forces had secured Okinawa.

The unit was decommissioned on 30 June 1946, but the designation NAMRU-2 had become so honored that it was applied to the Naval Research Unit which was established on Formosa after World War II.¹⁹⁴

Universities, Medical Schools, and Hospitals

American universities, medical schools, and hospitals responded gallantly when called on to meet the Army's medical laboratory needs in World War II, as they had in World War I (pp. 419-426). In many instances, the same physicians and scientists and the institutions of learning who responded during the limited national emergency and World War II, had responded in World War I. To this point, The Surgeon General, in his annual report for 1940 to the Secretary of War, stated, "Response to the invitation of The Surgeon General extended to medical schools and large hospitals to assume the responsibility of organizing military hospitals as affiliated units of the Medical Department has been uniformly enthusiastic. This is especially true of those institutions which in 1916 and 1917 organized base hospitals for service with the American Expeditionary Force." On 3 August 1939, the Secretary of War had approved the organization of affiliated hospital units as provided by the War Department Protective Mobilization Plan. Following this, The Surgeon General invited medical schools and hospitals to staff 32 general, 17 evacuation, and 13 surgical hospitals. Those who had staffed base hospitals in World War I were to be given the same numerical designation for the general hospitals which they volunteered to organize.

¹⁹⁴ See footnote 185, p. 591.



FIGURE 84.—Work of the U.S. Naval Medical Research Unit No. 2. A. Search for malaria in northern Okinawa. PhM2c. Warren G. Key and PhM2c. Merle H. Markley collecting blood samples. B. CPhM Lewis A. Posekany, Jr., “flagging” for mites.



FIGURE 84.—Continued. C. Comdr. Richard E. Shope, MC, USN, collecting snails for schistosome studies. D. NAMRU-2 Field Laboratory at Naha, Okinawa. Bacteriological studies of bacillary dysentery being directed by Lt. Comdr. F. Sargent Cheever, MC, USN (standing). In foreground (l. to r.), PhM2c. Norman F. Hunt, Jr., PhM1c. Joseph E. Crateau, and PhM2c. Jack W. Alexander.

The First Augmentation Plan called for additional affiliated units: 36 general, 13 evacuation, and 10 surgical hospitals. On 26 June 1940, Surgeon General Magee requested authority to activate these additional units. This authority was granted, thereby increasing the number of affiliated hospitals assignable to overseas theaters to 68 general, 30 evacuation, and 23 surgical hospitals.¹⁹⁵ These figures provide an indication of the needs for hospital pathologists and other hospital laboratory officers for but one of the relatively small segments of the medical laboratory organization. Another relatively small but important segment, the medical general laboratories, were also staffed largely by the country's outstanding medical schools and hospitals. Staff members of the medical general laboratories also were selected for specified positions. Very few of the pathologists and other laboratory scientists who were to become laboratory officers in affiliated hospitals, medical general laboratories, and other newly organized units, were Reserve officers. Indeed, on 30 June 1940, there were in the entire Medical Department Reserve 1,189 field-grade Medical Corps officers, 2,061 captains, and 12,049 first lieutenants. The entire Sanitary Corps Reserve consisted of 475 officers, of whom 71 had field-grade rank.¹⁹⁶ Since only a small percentage of those in the Reserve were laboratory officers, it is apparent that the universities, medical schools, and hospitals would be expected to release many of their higher ranking staff members who were pathologists, chemists, bacteriologists, and other laboratory scientists in order that the Army's many needs for laboratory officers could be met.

The Army Epidemiological Board exemplifies the contributions of the country's institutions of medical learning to the Army's preventive medicine program, a large segment of which arises from a foundation formed of the clinical, public health, and research laboratory disciplines (pp. 599-565). The physicians comprising the board occupied important positions in their medical schools and at the same time were on call as consultants for field investigations and for the conduct of research in their own laboratories on problems related to Army preventive medicine. Working under the auspices of the board were the commissions, many of whose members served the Army in the same capacities as did board members. The Fort Bragg laboratory of the Commission on Acute Respiratory Diseases was an outstanding example of a War Department installation staffed by members of faculties for the purpose of pursuing a particular research program.

Contributions to the Army's medical laboratory program also took the form of training programs for laboratory officers given at the universities, medical schools, and hospitals. In September 1943, the Training Division of the Surgeon General's Office promulgated a 12-week program

¹⁹⁵ (1) See footnote 5 (1), p. 422. (2) Smith, Clarence McKittrick: *The Medical Department: Hospitalization and Evacuation, Zone of Interior*. United States Army in World War II. The Technical Services. Washington: U.S. Government Printing Office, 1956, pp. 157-158.

¹⁹⁶ See footnote 5 (1), p. 422.

of instruction for clinical laboratory officers to be given at civilian schools and hospitals. Major segments of the 576-hour schedule for this program were devoted to bacteriology, parasitology, medical entomology, and chemistry with fewer hours set aside for hematology, serology, histology, pathology, and tropical medicine. The schools accommodating the larger registrations of medical laboratory officers for this program were the University of Michigan and the Johns Hopkins University School of Medicine and School of Hygiene and Public Health. Both schools had initiated training programs for laboratory officers more than a year before the release, in September 1943, of the Training Division's 12-week program.¹⁹⁷

ADDENDUM

The following references pertain to work carried out by laboratory officers independently or with their clinical and other associates. This listing is intended to be representative rather than complete and aims to show that, even under the trying circumstances in which the laboratory officer often found himself, it was possible to investigate and record the important observations contained in the papers listed below. Some of these references have been mentioned already in this chapter where they served to document studies carried out by a laboratory or other medical unit.

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